This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

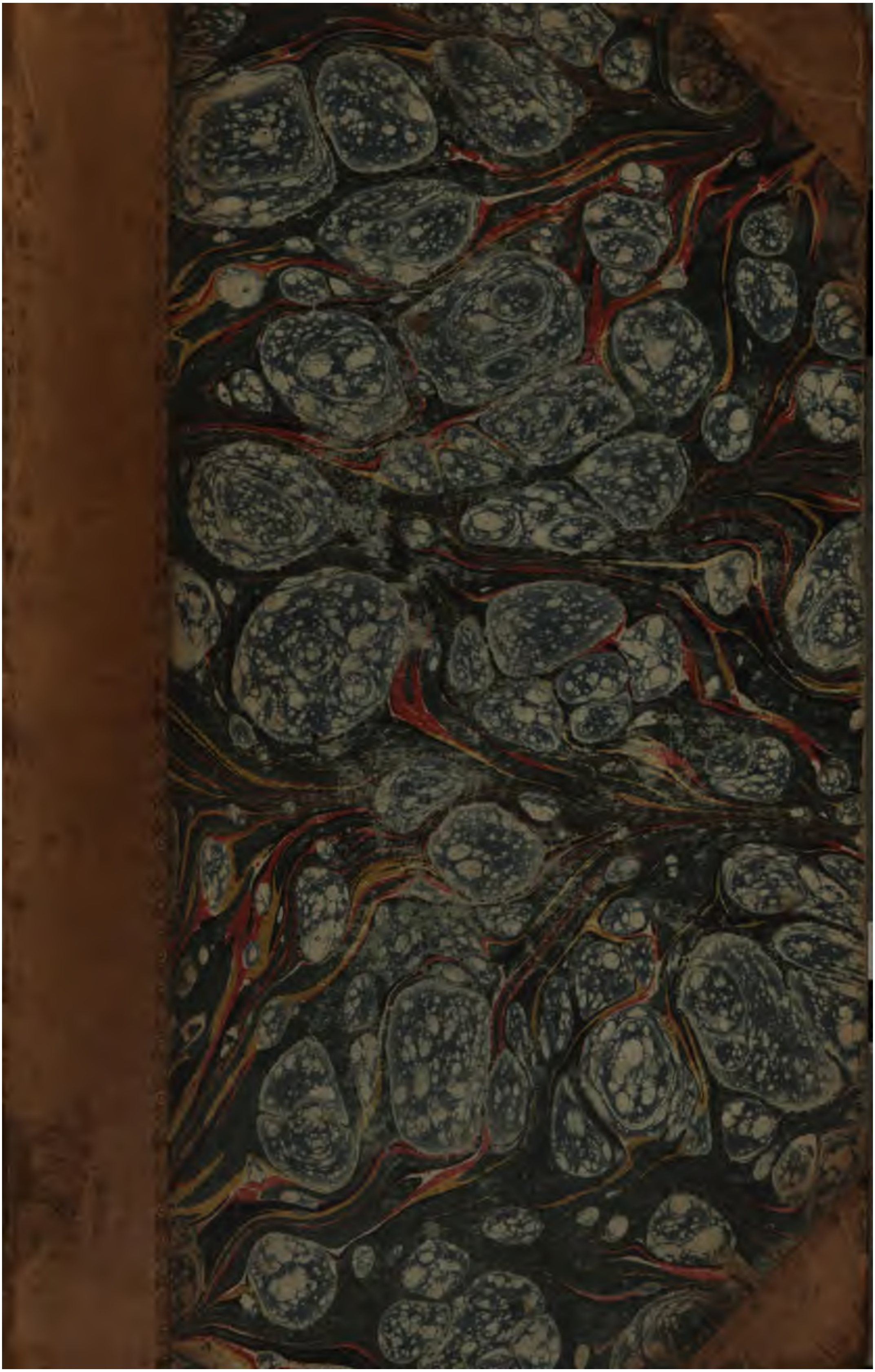
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



Per. 1771 e. 59/N.S.5

GILL'S
TECHNOLOGICAL REPOSITORY;

OR,

DISCOVERIES AND IMPROVEMENTS
IN THE
Useful Arts,

BEING A CONTINUATION OF HIS TECHNICAL REPOSITORY.

BY THOMAS GILL, *Patent-Agent,*
AND DEMONSTRATOR IN TECHNOLOGY, ON THE APPLICATION OF
SCIENCE TO THE USEFUL ARTS AND MANUFACTURES;
UPWARDS OF TWENTY YEARS A CHAIRMAN OF THE COMMITTEE OF MECHANICS IN THE
SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES,
AND COMMERCE, ADELPHI, LONDON;
HONORARY MEMBER OF THE ROYAL PRUSSIAN ECONOMICAL SOCIETY OF POTSDAM; AND
A CORRESPONDING MEMBER OF THE ROYAL BAVARIAN POLYTECHNICAL
AND AGRICULTURAL SOCIETIES OF MUNICH.

VOL. V.

LONDON:
PRINTED BY W. SPIERS,
399, OXFORD-STREET;
EDITED AT GILL'S PATENT AGENCY & COMMISSION OFFICE,
125, STRAND, NEAR TO SAVOY AND WELLINGTON STREETS;
PUBLISHED BY THOMAS HURST, EDWARD CHANCE, AND COMPANY,
65, ST. PAUL'S CHURCH-YARD;
AND SOLD BY THE FOLLOWING OPTICIANS, viz:—
CAREY, STRAND; BANCKS, STRAND; WATKINS and HILL, CHARING CROSS;
P. CARPENTER, REGENT STREET; WEST, FLEET STREET;
BATE, POULTRY; and JONES'S HOLBORN:
ALSO BY THE FOLLOWING BOOKSELLERS, viz:—
LONGMAN and CO. and BALDWIN and CO. PATERNOSTER ROW; W. SPIERS, OXFORD
STREET; LIMBIRD, STRAND; and GRIFFITHS, WELLINGTON STREET, LONDON:
LIKEWISE BY TRUETTEL and WURTZ, PARIS and STRASBURG:
and DOBSON, PHILADELPHIA:
AND BY OTHER PRINCIPAL OPTICIANS, BOOKSELLERS AND NEWSMEN IN TOWN & COUNTRY.

1829.

BIBLIOTHECA · BODLEIANA

GILL'S
TECHNOLOGICAL & MICROSCOPIC REPOSITORY.

I.—*On the Microscope.* *By the* EDITOR.

(*Continued from vol. IV., page* 334.)

WITH FIGURES.

Additional particulars, on a singular production formed upon the body of a dead larva of a gnat.—Since our last Article on the Microscope, the Editor has had another opportunity afforded him, of witnessing the growth of this production upon the dead body of another of these larvæ, and which was attended with still more singular circumstances than in the former case.

The same effects again took place, of the production of transparent tubes, filled at their ends with small spherical bodies; and which tubes burst open as the water gradually dried up, and these spherical bodies swam about in all directions in a lively manner, as before, and the ends of the tubes generally remained empty, and quite pellucid; orifices or openings at their ends, through which their spherical bodies had been protruded being also visible, and as shown in fig. 1, of plate I., at *a, a, a;* and their filled ends appearing as exhibited at *b, b, b.* However, on the Editor preventing the farther drying up of the water, by replenishing the cell continually with more water, in order to prolong the experiment, he was surprised at finding the growth of the tubes to continue, under his eyes as it were, during the whole of the day; and that the tubes became lessened in size, and grew longer; they passing out at the apertures remaining in the empty ends, as shewn at *c*, in fig. 1, until the field of view became filled with them.

Others of the tubes also ramified or divided themselves into branches, proceeding from the main stems, in the manner shewn at *d*, in our figure.

We shall content ourselves with recording these singular facts, and leave the reasoning upon them to those who are pleased with endeavouring to account for these astonishing productions.

The rapid growth of the tubes is perhaps one of the most singular circumstances attending this experiment; and we may add, those tubes which had not discharged their contents, at the time when the water was drying up, still continued to retain them during the whole period of its continuance.

On the exuviæ of the larva of the ephemeron.—This beautiful insect has, since our last article, thrown off *three more exuviæ*, all of which we have secured between slips of glass, as beautiful and permanent microscopic objects. Fig. 2 is a front view of the teeth, jaws, &c. copied from one of these exuviæ.

On the exuviæ of the pupa of the ephemeron.—Mr. A. Pritchard has lately shown the Editor one of two of these exuviæ, which had been left by an ephemeron which he bred to the perfect insect. This exuvia had two straight appendages at its tail, instead of the three beautiful feathered ones belonging to its larva state; and it remained standing upon its legs, in the manner in which the ephemeron had quitted it, through an opening in its back.

Our readers will find some highly interesting details respecting the ephemeræ, in our esteemed friend, Mr. Thomas Carpenter's communication for the present month.

On the change of a nais into the pupa of a gnat.—The nais is a beautiful jointed eel-like animalcula, with a head also like that of an eel; and having a number of hair-like bodies at its tail, which it can extend or contract at pleasure, like the ribs of an umbrella.

One of these, in the possession of the Editor, was lately found by him at the bottom of the water in the glass vessel in which he kept it, with its exuvia partly separated; and indeed, it was its shining bright appearance, that first led him to remove and examine the insect.

Upon placing it under a microscope, he found that the greater part of it had completed its change, into a well known pupa of agnat, with two forked appendages at its tail; but that three joints of the body of the nais, considerably enlarged indeed, and its eel-like head, still remained without having undergone the change into the pupa state; the greater part of the the exuvia of the nais still adhering to it, and which is delicately ribbed or furrowed longitudinally.

This fact has now explained the appearance of similar pupæ of gnats, with small horns upon their heads, in glasses of water in the Editor's possession; and which he could not account for, as they only contained the nais.

On the larvæ of the hydrophilus, or great water-beetle.—The Editor has three very minute larvæ of this insect in his possession, not near the size of those figured in the last number of Goring and Pritchard's work, "*On Living Objects for the Microscope;*" indeed not larger than one of the legs of it; but nevertheless, nature has armed them with the same destructive weapons, and they are equally expert in using them. One of them lately attacked another larva, with beautiful bands of purple all along its whole body, and quickly mastered it, and then commenced swallowing it, under the observation of the Editor, with the assistance of a single lens of half an inch focus; in this manner he continued his work for an hour, his body gradually becoming of a purple colour, in consequence of receiving that of the purple larva within it, the actions of devouring and swallowing it being distinctly visible; at length he had swallowed all but the hinder part, this he bit off and left behind; being possibly annoyed by the numerous sharp and hooked claws attached to each hinder leg of the purple larva, and which form beautiful microscopic objects, each claw being also furnished with its own muscle and tendon. Two of these larvæ will also frequently attack a water-beetle, which is in the same glass vessel with them, and they even often fight each other.

On the Editor's facile mode of mounting small transparent objects for the microscope.—He has at length effected this desirable end, in a manner which leaves little to be wished for; as it combines a great rapidity in accomplishing it, with every accommodation for securing and viewing the objects. In this mode he has preserved the four exuviæ cast off by his larva of the ephemeron; and the last one in particular, notwithstanding its exquisite texture, is complete in every part, even to the minute threads which terminate its antennæ, and the three beautiful feathered appendages to its tail.

He has before published a method of accomplishing this, in the third volume of this work, page 195, to which we must refer our readers; the additional improvements consisting in laying the small slip of very thin Bohemian plate glass (not more than the twentieth part of an inch in thickness) *lengthways*, upon the other larger slip of thicker plate glass, instead of across, as before recommended; the object being placed between them, and if surrounded with water, it will be more likely to diffuse or spread itself more perfectly between the glasses; the two glass slips are to be *bound tightly together*, with twine wrapped and tied around them, and the excess of water which has ouzed from between them must be carefully wiped away: they are then ready to be cemented together with sealing-wax. In order to do this, one end of the larger, broader, and longer glass slip must be heated over the flame of a candle, until it becomes hot enough to melt the sealing-wax, which is then applied along that end of the smaller and thinner glass slip, in a slender line or coat. It must then be again heated until the sealing-wax forms air-bubbles, and flows a little between the ends of the two glasses, when it may be suffered to cool. The same process is then to be repeated at the other ends of the glass slips; and when cold, the sealing-wax must be scraped off the surface of the thin slip, leaving it still attached to the ends of it, and to the surface of the thicker and longer slip, which forms the basis of the thinner one, and supports and strengthens it. The thinner and more expensive glass may be thus no larger than is sufficient to cover and protect the object properly; and a plate of the thin Bohemian glass may thus be cut into short and narrow slips with the diamond, and be made to enclose a considerable number of different transparent objects for the microscope, and which will thus not be found too costly for general adoption. The great advantages of glass over talc are too well known, in respect to its clearness and durability, to need dwelling upon here.

Where the Bohemian thin plate glass is not to be procured, the opticians may grind and polish flat glasses, thin and large enough to be used in the above manner; and the numbering the objects, for the sake of registering them, may be readily effected with the writing diamond, upon the thicker supporting glasses.

(To be continued.)

II.—*On the Ephemeron, the Musca Chamæleon, the Musca Pendula, a Tenebris, the Psocus, and other Insects &c. By* THOMAS CARPENTER, Esq.

WITH FIGURES.

DEAR SIR, *London, June 5, 1829.*

YOU having mentioned in your last volume, page 332, that you had succeeded in procuring the cast skin or exuvia from the larva of the Ephemeron, I herewith send you one, which was thrown off by the insect while in my possession, and in which you will perceive the fine vessels in the fins or paddles, and likewise the delicate feathered tail, and also its compound eyes. If you refer to Swammerdam, in plates 13, 14, and 15, you will observe that he has given a fine anatomical display of this larva. A few days since, I had the pleasure of seeing exhibited under our friend Mr. Philip Carpenter's grand solar microscope, one of these larva, whose natural size was only about half an inch, magnified to the amazing length of *fourteen feet!* I was astonished at the defining power of this unrivalled instrument; every part of the insect was accurately shown in its focus; the quick vibrations of its paddles, and its fine feathered tail (which I observed was covered over with hundreds of the bell-polypes) were distinctly seen at the same time; and indeed it was the most perfect exhibition of the kind I ever beheld. He also magnified the larva of a gnat (whose head you have given a figure of in plate VI. vol. IV., of your Technological Repository) to upwards of nine feet in length; this likewise was amazingly grand. The motions of its intestines were very distinctly seen. I cannot do justice to this exhibition by description, but would recommend to your readers to pay a visit to Regent Street, in order to view a sight, that for magnitude, combined with accuracy, has never been before produced.

As the ephemeron insect, in its perfect state, lives but a few hours, perhaps some facts respecting it, with a short account of its history, may be interesting.—The general case with these insects is, that immediately on their coming forth perfect, they each seek their mate, copulate, deposit their eggs, and die; but if kept separate, Nature seems to protract their existence for a greater length of time, in order that the sexual intercourse may take place. To prove which, on the 25th May, 1820, I caught one of these insects, *ephemera vulgata*, in its pupa state, a few minutes previous to its change into the perfect insect. As soon as it had quitted its pupa case, I placed it under a wine glass, in which situation it lived four days; probably it would have lived a longer time had more air been admitted under the glass. Herewith I send you the identical insect with its pupa case; also two of its four wings, placed between slips of glass; these will serve as fine objects for the lantern or solar microscope, as in either instrument the reticulations in the wings will be finely shown. I also send you another specimen of this insect, which had died in the act of leaving the pupa case. The insect had not sufficient strength to enable it to get its wings completely out. You will observe a part of them are within the case. This was one I had kept in the larva state for some time, in a bason filled with water. I imagine its weakness was occasioned by its want of liberty. There appears to be many other insects, as well as the ephemeron, that live but a short time after the union of the sexes take place; but if by any means that be put off or prevented, their life may be protracted to three or four times that period.

Gleditsch asserts, that by keeping apart the sexes of the grasshopper, their lives were prolonged to eight or nine weeks, instead of two or three, their ordinary period; and under similar circumstances, ephemeræ, which usually perish in a day, have been kept alive seven or eight. It is in consequence of this very curious fact, which has not received from physiologists the attention that it merits, that many butterflies and other insects, which, when excluded from the pupa in summer perish in less than a month, live through the winter, if excluded late in the autumn, and the union of the sexes does not ensue. A parallel case happens in the vegetable kingdom:—If annual plants are kept from seeding, they will become biennial: as for instance, if they are sown too late in the year to produce seeds. I shall now proceed to give you a condensed history of the ephemera:—These insects differ in many respects from all others. Their larvæ live in water for three years, this time they consume in preparing for their change, which is performed in a few moments. The larva, when ready to quit that state, arises to the surface of the water, and getting rid of its skin, instantaneously becomes a crysalis. The crysalis is furnished with wings, which it makes use of to fly to the nearest tree or wall, and there settling, it in the same moment casts a second skin, and becomes a perfect ephemeron. In this state all the species live but a very short time, some of them scarcely half an hour, having no other task to perform than that of continuing the race. They are called the insects of a day, but very few of them ever see the light of the sun, being produced after sunset, during the short nights of summer, and dying long before the dawn. All their enjoyments therefore seem confined to their larva state.

The ephemeræ are very frequent near waters, and in some places multiply enormously. About Lass, in Carniola, a province in Germany, they are so numerous in the month of June, that though but small insects, they are used as manure, and the peasants think less than twenty cart loads but a bad harvest.

The larvæ scoop out dwellings in the banks of rivers, which consist of small tubes, made like syphons, with two holes, the one serving for an entrance, and the other as an outlet; and these are so numerous, that the banks of some rivers are often full of them. When the waters decrease they dig fresh holes lower down. The flies are hatched nearly all at the same instant, and in such numbers as even to darken the air. The females, by the help of the threads of their tails and their wings, support themselves on the surface of the water, and in an almost upright position, drop their eggs in little clusters into the water. A single insect will sometimes lay seven or eight hundreds. The mouth of the perfect insect has no jaws, but is furnished with four short thread-shaped feelers; the antennæ are short and thread-shaped; and above the eyes are two or three large stemmata; the wings are erect (the lower one much the shortest) and the tail is terminated by long hairs or bristles.

Reaumur has very accurately described the metamorphosis of one species, which, except in the time of the year when it is produced, and in the duration of its fly state, seems very much to resemble the *ephemera vulgata*, and is most probably nothing more than a variety. On the nineteenth of August, 1738, he waited for some time after sunset on the bank of the Seine, to see, as he had been informed he might, millions of ephemeræ come out of the water, and rise into the air, and was returning disappointed, along with his servants, who were carrying a tub containing several lumps of earth full of the holes and nymphæ, when scarcely had it been set on one of the steps of the stairs, than those who had the charge of it exclaimed, "What a vast quantity of ephemeræ are here!" M. de Reaumur seized one of the lights, and ran to the tub. Every part of the earth that was above the water was covered with ephemeræ, some of which had just begun to put off their coverings, others had almost effected it, and others entirely completed it, and were about to take wing. A storm of lightning and rain, which had been some time coming on, now drove him into the house; but to prevent the ephemeræ from flying away entirely in his absence, he had the precaution to cover the tub with a cloth. The violence of the rain continued for about half an hour, and on its ceasing he returned to the garden. On taking off the covering he found the number of ephemeræ very considerably augmented, and they continued to multiply for some time, as he stood watching them. The number already produced from the earth that they had conveyed from the river would have been sufficient to have filled the tub; but this number was prodigiously augmented by the accession of strangers, which were attracted by the light from all quarters. He again spread the cloth over the tub, and the light was held above it; immediately the cloth was almost concealed by the vast multitudes which alighted upon it. But the numbers he had seen about the tub were nothing to what he saw when he went again to the side of the river. "The quantity of ephemeræ," says he, "which filled the air, can neither be expressed nor conceived. When snow falls the thickest, and in the largest flakes, the air is never so completely filled with them, as that which surrounded us was with ephemeræ. Scarcely had I remained a few minutes in one place, when the step on which I stood was covered in every part with their bodies, to the depth of two or three, and in some places even of more than four, inches. The whole surface of the water, for six feet at least from the bank, was entirely covered with a coat of ephemeræ; those which the current carried off were more than replaced by those which fell continually in that place. I was several times obliged to abandon my station, by retreating to the top of the stairs, not being able to sustain the shower of ephemeræ, which not falling so perpendicularly as an ordinary shower, or with an obliquity equally constant, struck me uninterruptedly, and in a very troublesome manner, on all parts of my face; my eyes, nose, and mouth were filled with ephemeræ. It was an unpleasant post to hold the candle on this occasion; the man who held it had his whole body covered with those flies in an instant: they rushed to him from all parts in such quantities as to oppress him. The light of the candle occasioned a spectacle altogether different from any thing that can be observed in any kind of meteorological shower; it was enchanting when once observed. The most unobserving of my domestics could scarcely ever have been tired of admiring it. No astronomic sphere was ever formed so complicated as it was, nor furnished with so many circular zones in every possible direction, having the flame of the candle for their common centre. Their number appeared to be infinite, having all possible degrees of obliquity with respect to each other. Each zone was formed by an uninterrupted line of ephemeræ, which, as if tied together, followed each other close—they seemed to form a circular riband of silver, deeply indented on its edges; a riband formed of equal triangles joined end to end; so that the angles of those that followed, were supported by the base of that which preceded, the whole moving round with great quickness.

"Each of these flies, after having described one or two orbits round the flame, fell to the earth, or into the water, but without having been burned by the flame of the candle. At the end of about half an hour from its commencement, the great shower began to abate, and in little more than an hour, scarcely any ephemeræ could be seen above the river, and no more came near the candle."

This phænomenon M. de Reaumur found, upon examination, took place every evening, commencing usually about the same hour, during most of the summer months. In this short period of existence, the female appears to have no other business to perform than to lay her eggs. These are held in two large packets, each containing from three to four hundred, which are both extruded from the body at the same time, through two openings formed for that purpose, and they fall together, in one accumulated mass, upon the water. To enable the creature to extrude these, and at the same time to fill up the great vacuum in the abdomen that must instantaneously take place, the fly is provided with a couple of small bladders, which it has the power of filling with air. The singular quickness and ease with which these little creatures strip themselves of the slough of the nymph, in order to become flies, is very surprising. We do not draw our arm more quickly from the sleeve of a coat, than the ephemeron draws its body, its wings, its legs, and the long filaments of its tail, from that complicated vestment, which forms a kind of sheath for all these parts. No sooner is a rent effected in the corselet, and the body seen through that rent, than the rest of the operation is finished in an instant. Sometimes indeed it happens, that the filaments of the tail cannot be so quickly disengaged as the rest of the body; in this case the insects fly away with their slough appended; and sometimes also these slender filaments are broken off.

Towards the end of the summer of 1823, I procured from a pond near Edmonton, a couple of the larvæ of the *musca chamæleon*, for the purpose of breeding the perfect insects under my own inspection; and also to watch their progress in the change towards it; for which purpose I kept them in a vessel, partly filled with mud from the bottom of the pond, and a little water. At the expiration of six weeks, having observed a change in them taking place towards their becoming pupæ, I took them out of the mud and water, and placed them in a pan, within which I had previously put a small piece of turf, fresh cut from the earth, and some water; but taking care not to cover the turf with water. I observed, that in a short time they both disappeared, having buried themselves under the earth. This piece of turf I kept moistened from time to time, during the whole of the winter, and also in the early part of the spring; and in the month of June, 1824, I observed one of them had changed into the fly state, and was crawling up the side of a glass which I had placed over the pan. I waited until August, in expectation of the other fly coming forth, but was disappointed. I therefore sought after it, and found it dead, in the pupa state. This pupa, the fly, and its crysalis case, I herewith send you for your inspection. The eyes are large, and compound ones, consisting of upwards of twelve thousand! In examining the perfect insect you will discover many beauties. Since the above period I have produced the flies after a similar process. The larva of this insect has been noticed by writers on natural history, from the beautiful star-like appendage at its tail. If you refer to Adams, plate 11, and also to Swammerdam, plate 39, you will find tolerable figures of this curious larva; but the most correct I ever saw, is a drawing, made from one of the larva, by my respected friend, Dr. Goring: it is a most accurate and beautiful delineation of this wonderful insect. I sincerely hope Dr. Goring will favour the public with an engraving from his valuable drawing, in the interesting work he is now publishing, entitled, "The Natural History of Living Objects for the Microscope."

The parts most worthy of notice in the larva of this in-

insect, according to Linnæus, are the tail, and the snout or trunk. The tail is furnished with an elegant circle of hairs or feathers, disposed quite round it in an annular form; by means of this tail it is supported on the surface of the water, while the worm or larva is moving therein; the body in the mean while hanging downwards, or towards the bottom, in search of food.

When it is disposed to sink to the bottom, it turns the hairs of the tail towards each other; hollow in the middle, but close towards the extremity: by these means a conical space is formed, and the bladder of air pent up in it looks like a pearl. It is by the assistance of this little balloon that the insect raises itself again to the surface. If this bubble escape, it can replace it from the pulmonary tubes. Sometimes large quantities of air may be seen to arise in bubbles, from the tail of the worm to the surface of the water.

This operation may be easily seen, by placing the larva in a tumbler of water, where it will afford a very entertaining spectacle. The snout or trunk is divided into three parts, of which that in the middle is immoveable; the other two parts grow from the sides of the former; these are moveable, vibrating in a very singular manner, like the tongues of lizards and serpents. The greatest strength of the animal resides in these lateral parts of the snout; it is on these that it walks on the bottom of the water, and also on dry land; appearing, as it were to walk on its mouth, and using it as a parrot does its beak, to climb with greater advantage.

In the summer of 1819, I met with several larvæ in a shed at the bottom of my garden, of a very disgusting appearance, and having very long tails. On examining them, I found them to be the larvæ of the rat-tailed worm fly, *musca pendula,* and wishing to procure the perfect insect, I put several of the larvæ into a box, filled with bran; and as they appeared to be advancing towards their change into the pupa state, I expected to breed the flies from them. One of the larva I put into spirits of wine for future examination. On the 12th of August, in the same year, several of the flies had come forth. On their first coming out of the pupa case they appeared to be without wings, but in a short time they spread them open in a very perfect manner. One of the flies, from some injury it had sustained in the larva state, was crippled in the wings, which have a very singular appearance. These flies are to be met with on almost every flower in the autumn of the year; but I was not a little astonished, on the 19th of August, 1827, on passing over Waterloo Bridge, to observe the ballustrades covered in many places with vast numbers of them; they appeared very weak, as if they had just emerged from the crysalis state. Now the question is, where they could have come from? It was not merely a few, but many hundreds; and also on the same ballustrades there were a great many of the larger species of ladybirds in company with them. The *musca pendula* possesses very powerful instruments for cutting open the parts of flowers for the purpose of extracting the juices. I send you, with the insects above described, a fine dissection of the tongue of one of these insects. You will perceive the apparatus for tearing open, separating, and extracting the sweets from the flowers. You will also observe the groove in the trunk or tongue, out of which these instruments were taken, and within which they lie folded up when the insect is not feeding. The dissected eyes are also between the same glass, consisting of many thousands, of various figures. There is likewise between the same glass slider, a singular apparatus, which was affixed at the end of the abdomen; and also several lancets, taken out of a species of *tabanus*: the character in the lips of this tongue are finely displayed. Between another slip of glass, is another dissected tongue, from the same species of the rat-tail worm fly, and also the sting of a wasp. This same wasp had seized the fly, and having alighted with its prey on the ground, first cut off its wings to prevent its escape, and then began to eat the muscular flesh from the under part of the thorax of the fly; for when I took them up, I found the wasp had opened that part with its powerful jaws, and had eaten a great portion of it. I put them both to death, out of compassion to the poor suffering fly, as well as the wasp, that being unable to fly, from having lost one of its own wings in the contest. The various parts of the fly's tongue are finely shown; as is also the sting of the wasp, the darts being drawn forwards, in order to show the connection between them and the sheath. I also send you a piece of card, on which is placed the head of one of these musca, and the sting and poison bag of a large wasp, for the purpose of explaining the vitality of these two insects. I found them both together in the foot path, apparently crushed to death. I cut off the head of the fly for the purpose of examining and dissecting its proboscis, and was much surprised, that after the head had been separated from the body several hours, in pulling out the tongue in the manner it now is displayed, the muscles moved the tongue about in various directions, and afterwards drew it into the mouth. This was repeated several times; and in order to keep it out its present length, I was obliged to pin the end of it to a piece of cork! There are some curious spines in the tongue, some of which I have separated.

The abdomen of the wasp I had separated from the thorax, and did not examine it for two days; at the expiration of that time I took it out of a pill-box in which I had placed it, and was preparing to extract the sting, when there still appeared as much vitality in it, as if the insect had been in a perfect state, and in full vigour. The sting was thrust out and drawn into the body repeatedly.

Reaumur paid great attention to the œconomy of the rat-tail worms I have just been describing, and for which purpose he collected a number of them; these he put into a glass vessel, filled two inches high with water. At first they were considerably agitated, each seemingly searching for a proper place of repose. Some of them swam across, others attached themselves to the sides, and others rested at the bottom of the vessel. In a quarter of an hour they were almost all entirely tranquil; and Reaumur soon discovered the real use of their long tails. On examining the vessel, he found that each of the insects, in whatever situation they were placed, extended its tail exactly to the surface; that like other aquatic insects, the respiration of air was necessary to their existence; and that the tail, which is tubular, and open at the extremity, was the organ by which this operation was performed.

In this experiment, the distance from the bottom to the surface of the water was two inches; and of course the tails were of an equal length. To discover how far the insects could extend their tails, this most ingenious and indefatigable philosopher gradually augmented the depth of the water, and the tails uniformly rose to the surface, till it was between five and six inches high. When the water was raised higher than this, the insects immediately quitted their station at the bottom, and either mounted higher in the water, or fixed themselves upon the sides of the vessel, in situations which rendered it convenient for them to reach the surface with the points of their tails. These tails consist of two tubes, both of which are capable of extension or contraction; the inner one, like the tube of a telescope, being retractile within the other. The first tube is always visible; but the second, which is the proper organ of respiration, is erected only when the water is raised beyond a certain height. Through this tube the air is conveyed into two large tracheæ or wind-pipes, within the body of the insect, and thus maintains the principle of life. When the tails are below the surface of the water, the insects occasionally emit small bubbles of air, which are visible to the naked eye, and they immediately repair to the surface for fresh supplies. So anxious is Nature to provide animals in every state of their existence with air, that after the transformation of many insects into crysalids, she creates instruments expressly for that purpose; and which did not exist previous to their transformation. These rat-tailed worms, soon after they are transformed into crysalids, instead of having a soft pliable skin, are covered with a hard crustaceous substance, seemingly impervious to the air; and the tail, which was the wind-pipe of the insect in its first state, gradually vanishes. In a few hours, however, four hollow horns shoot out, two from the fore, and two from the hind, part of what was the head of the animal. These horns, which are hard and tubular, M. de Reaumur discovered to be real wind-pipes, destined for the introduction of air into the crysalis; a state in which many animals have the appearance of being almost totally dead, and of course should seem to have little use for respiration. He likewise discovered that these horns, which had pierced the hard exterior covering, terminated in as many tracheæ in the body of the animal.

This fact affords a strong example of the necessity of air for sustaining the principle of life, even in its lowest condition. After these animals pass from the crysalis state to that of flies, they are deprived both of their tails and horns. But Nature, in this last stage of their existence, has not left them without proper resources for the introduction of air into their bodies. Instead of protuberant tracheæ, in the form of tails or horns, they now, like other flies, receive air by means of stigmata, or holes, variously disposed over different parts of the body. These rat-tailed worms pass the first and largest part of their lives, which is supposed to be several months, under water. When near the time of their transformation, they leave that element, retire into the ground, and then become crysalids. From this state they are changed into beautiful flies, and spend the remainder of their short existence in the air; and are frequently found on flowers in the autumn. The various experiments on these insects by M. de Reaumur will be found illustrated in his work, "On the History of Insects," plates 30, 31, and 32.

Since I concluded my last letter on the subject of the cock-chafer, a beetle has made its appearance from the pupa state, whose antennæ deserve inspection from their curious articulations; and which are at the same time so very different from those of the cook-chafer. This insect is a species of the genus *tenebrio*, and produced from a larva, which I observed last autumn, among some dried wood and dirt in my cellar. At the time I found it, it appeared to be about to undergo its change into the pupa state; I therefore put it into an earthen pan, with some of the materials in which it was crawling, and then covered the pan over with a piece of tin, perforated with holes to admit air. It remained in the pan during the whole of the winter; and a few days since, the perfect insect, which I now send you, came forth. The species of this genus, according to Linnæus, are numerous, amounting to about ninety. Some species of the larva reside among rotten sticks or rubbish; those of others take up their abode among flour, and different kinds of food. After they have become perfect insects, they enter houses, and devour every sort of provision; their principal resort, however, is to damp cellars, where the putrid air and darkness attract them. It is from their precipitately avoiding light, as well as from their gloomy appearance, that they derive their generic name of *tenebrio*, the darkling. One species of this genus is *t. molitor*, and which proceeds from a larva, commonly called the mealworm, from its being so frequently found in flour, &c. In this state it is considered as the favourite food of the robin and nightingale, when they are kept in a state of captivity. This is said to remain two years in the larva state before it changes into the crysalis. Two of the perfect insects, which I bred from the larva, I now send for your inspection, together with one of the larva. According to Kirby and Spence, vol. I., page 134, of their work on Entomology, there is abundant evidence, which proves beyond controversy, that the meal-worm, although its usual food is flour, has often been voided both by male and female patients; and in one instance is stated to have occasioned death. How these grubs should get into the stomach it is difficult to say; perhaps the eggs may have been swallowed in some preparation of flour; but that the insect should be able to sustain the heat of this organ, so far exceeding the temperature to which it is usually accustomed, is the most extraordinary circumstance of all. I also send for your inspection a few insects of the genus *psocus*. These I found among some dry underwood, near Hampstead Heath, last summer. The heads of these insects present a most singular appearance under the microscope; the eyes also, which are compound ones, are very large and prominent; and the markings or characters about the head, &c., are very curious. With these you will also receive a fine specimen of the larva of the *cicendela campestris*—be pleased to observe the eyes and fangs of this formidable creature. You are in possession of the cast skin of the common house spider; I now send you the cast skin of one of the field hunting spiders. The teeth attached to the claws of this species are very strong; as are also the spines, &c. on various parts of the body. I likewise send you a portion of one of the wings of the *libellula depressa*, with some very singular crystallizations on some of the reticulations. Also some of the plates, to which the muscles of the jaws were attached in the head of the same fly; and by which means action was given to the powerful jaws of this insect. These you will find worthy your examination.

As some of your microscopic readers may be in want of objects not usually furnished them by the opticians, I beg to point out to their notice the curious scales found on eels, and also on the guard fish, which accompany the mackrel. I observe great plenty of these fish in London at this time, therefore there will be no difficulty in procuring the scales, which are very interesting objects; they resemble curious marked shells. The fine scales from the wing of the gnat are also excellent test objects; a few specimens of each of these objects I also send.

I have not entered very minutely into the characters of the various objects herein mentioned; as probably, when you have examined them, you will feel inclined to make some observations upon them, and favour your readers with drawings from such parts as you may consider interesting.

I remain, dear sir,
Your obliged friend,
THOS. CARPENTER.

To THOMAS GILL, *Esq.*

Remarks by the EDITOR.

In plate I. fig. 3, we have given a representation of the tongue, proboscis, and instruments of the *musca pendula,* or rat-tailed fly. Fig. 4 is one of the antennæ of a beetle, of the genus *tenebrio.* Fig. 5, the head of the *psocus.* Fig. 6 are the strong hooks which are affixed upon tubercules, on the back of the larva of the *cicendela campestris,* and by which it affixes itself to the sides of its cave, as described in our last volume, page 22. Fig. 7 is one of the two claws, with teeth affixed in it, from the foot of a field hunting spider. Fig. 8, one of the plates, to which the muscles of the jaws of a *libellula depressa* were detached. Fig. 9, one of the scales of a guard-fish. And fig. 10, part of the wing of a gnat; in which the fine ribbed scales, or feathers, which form the fringe or border of it; and some of the others, arranged like the leaves or sprigs of vegetables, are distinctly seen.

III.—*On an improved Apparatus for producing instantaneous light. By Mr.* George Jackson, *Surgeon* [*].

WITH FIGURES.

30, Church-street, Spitalfields,
April 25, 1827.

SIR,

I BEG leave to inform you, I have contrived, what I conceive to be an improvement on the apparatus usually employed for obtaining light, by means of hydrogen gas and spongy platinum; and shall feel particularly obliged by your laying the same before the Society of Arts.

The objects which I had in view in constructing this apparatus, were *simplicity* and *cheapness*. In these I have so far succeeded, that the uncovering of the cup of platinum is now rendered unnecessary, and a taper is fixed in a situation to be lighted, by simply turning the cock; the instrument can also be sold at about one half the price of those in common use.

My attention was turned to this subject, by frequently having occasion for a light, when called to the practice of my profession by night. I tried, in succession, the phosphorous bottle and the oxygenated matches, and was fitting up an instrument on Volta's plan, when Doboreiner's discovery of the action of hydrogen upon spongy platinum was made public. I then substituted a cup, with spongy platinum in it, for the electrophorus of Volta, and in that state used the apparatus for some time, before I thought of making any improvement on it.

The instrument which I have the honour of laying before the Society, consists of an inverted glass syphon, made of stout tube, about half an inch outside diameter, and having a bulb, about two inches and a quarter in diameter, blown on each leg of it. The bend of the syphon is cemented into a wooden foot, loaded with lead; and the bulb on the longer leg stands about six inches (measuring from centre to centre) above that on the shorter one. The tube extends about an inch above each bulb; that from the upper one is simply covered with a loose brass cap, more for ornament than use. On that which rises from the lower bulb a brass cap is cemented, into the top of which a conical or tapering brass plug is ground, with a hole drilled partly across it, met by another hole drilled up the centre, so as to form a stop-cock. A jet, with a fine orifice, is screwed into the side of the cap, so as to communicate with the lower bulb, through holes in the plug, when the latter is turned into the proper position; and just below the jet an arm projects, which carries a short piece of brass tube, lying horizontally, that serves to support the platinum, and protect it from accidental displacement. The end of a thin platinum wire is formed into a small helix or spiral cylindrical coil, of two or three turns, by winding it round a wire or glass rod, and is then to be covered with moist ammonio-muriate of platinum. It is then heated to redness in the flame of a spirit-lamp, again coated with ammonio-muriate, and again heated, so as at length to form a platinum sponge, from the size of a pepper-corn to that of a pea. The wire is then attached to a ring, made of a short piece of brass tube, of a size to admit of being pushed tightly into that piece of tube which is supported by the arm abovementioned; so that the platinum sponge hangs in the centre of the tube, directly before the jet. In the arm, between the jet and the platinum, and a little to one side, is a hole, just large enough to contain a piece of wax taper, the wick of which is thus placed, so as not to obstruct the jet of gas, but yet near enough to be lighted by it when it is inflamed. In the part of the tube between the bend of the syphon and the lower bulb, a cork, grooved at the sides, is inserted, to prevent the slips of rolled zinc from falling into the bend of the syphon.

---

[*] From Vol. XLVI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its silver Isis medal to Mr. Jackson.

To charge the instrument for use, the brass plug is taken out, and a number of narrow slips of zinc, about two inches long (cut from a piece of the thin malleable metal) are introduced into the lower bulb, which is then nearly filled with diluted sulphuric acid, poured through the upper orifice. As soon as a brisk action commences, the plug is replaced, and the gas, accumulating in the lower bulb, drives the acid into the upper one; when, it quitting the zinc, the farther production of gass ceases. The lower bulb being thus filled with hydrogen, on turning the plug a portion of it escapes through the jet, becomes ignited by its action on the platinum sponge, and lights the taper; a portion of the acid at the same time descending from the upper bulb, acting on the zinc, and causing a fresh production of gas. It is not very material how much the acid is diluted. That which I have used is made by mixing one measure of oil of vitriol (sulphuric acid) with about ten measures of water, and it answers very well.

In the instrument in the Society's possession, the upper bulb is about six inches (from centre to centre) above the lower one. I have since made one, wherein the distance is only four inches, and I think it lights with rather less expenditure of gas.

To prepare the ammonio-muriate of platinum, a solution of the metal in nitro-muriatic acid is dropped into a solution of muriate of ammonia in distilled water, and the yellow precipitate is collected in a paper filtre. Should it become dry, it must be moistened with *distilled* water, when using it to coat the platinum wire, and form the sponge.

I am, sir, &c. &c.

GEORGE JACKSON.

A. AIKIN, Esq.
Secretary, &c. &c.

References to the figures.

In plate I., fig. 11, *a* is the stopper, or conical plug, through which the zinc is introduced into the bulb *b*; it is prevented from falling lower than *c*, by a notched cork placed within the bend of the tube. Diluted sulphuric acid is poured in through the bulb *d*, till it fills the bulb *b*; the stopper *a* is then put in, and as the hydrogen gas is generated, the liquid is forced down through the bottom of the tube *c* into the tube *e*, and the bulb *d*, so that none remains in contact with the zinc. The stopper *a* also forms the plug of the cock, it being hollow, as shown in section, in fig. 12; and on turning its lateral aperture opposite to the jet *f*, the gas is pressed out by the weight of the fluid in *d* and *e*, and blows against the mass of spongy platinum, suspended upon the platinum coil in the short tube *g*; the platinum becoming red hot, kindles the jet of gas which heated it, and this flame lights the wax taper *h*, which is held in a hole formed in the arm *i*; this hole is placed so much on one side of the jet, as to let the wick only just touch the flame of gas; and the arm *i*, which holds the piece of wax taper, is soldered to the brass neck *j*, and to the tube *g*. Fig. 13 is a full sized section of the tube *g*; within it slips a shorter ring of tube *k*, round the upper part of which the fine platinum wire is wound and twisted, which holds the spongy platinum; and thus the platinum, though hanging free of the sides of the tube, and thereby more quickly becoming red hot, than if in contact with it, is protected from accident, and is always placed opposite to the jet of hydrogen gas.

IV.—*On a New, Simple, Cheap, and Portable Bellows, for Miniature Glass-blowing.* *By* M. DANGER*.

THE enameller's table, which is always expensive, is likewise bulky, and occupies a considerable space. The apparatus invented by M. Danger is, on the contrary, of an exceedingly moderate price, and can be packed up in very little compass.

It consists of a bladder, which is affixed by a tube of glass to a piece of wood, serving as a foot to it, and by which it can be secured upon a table; this block of wood also supports a curved tube, which directs the air properly upon the flame of the lamp. Another bent tube serves to convey the wind from the mouth of the workman into the bladder. The apparatus being affixed to the table, the artist places the filled bladder between his knees, producing thereby any convenient degree of pressure upon it; in order to replace the air which is thus expelled, it is sufficient to blow in a small quantity from time to time as required.

---

* From *Bullet. de la Soc. d'Encourag.*, September, 1828; and Ferussac's *Bulletin des Sciences Technologiques.*

To hinder the air from escaping by the mouth tube, M. Danger has placed a small valve upon its inner end, which is made with a small bit of cork, affixed to a copper wire.

We can easily conceive, that by means of this exceedingly simple apparatus, glass may be worked into every required shape; and M. Danger, who is a very expert workman, is enabled to effect every thing by its use, which can be done by the bellows and the glass worker's lamp.

It is obvious that the bladder, when emptied of air, will occupy but very little room, and that the apparatus thus becomes exceedingly portable.

V.—*On a Ladder-Crane. Invented by Mr.* W. H. HILTON, *Wine Merchant*[*].

WITH FIGURES.

10, *Regent-street, Pall-mall,*
January 10, 1827.

SIR,

I BEG, through your medium, to introduce to the Society of Arts, a model of a ladder-crane, the peculiar advantage of which is, that it can be used where it is impossible to erect those used in common; it is also cheap and safe. Four years ago I attached it to an old step-ladder, and have found it answer every purpose for which it was intended.

---

[*] From Vol. XLVI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its silver medal to Mr. Hilton.

I am, sir, &c. &c. &c.
W. H. Hilton.

A. Aikin, Esq.
Secretary, &c. &c.

References to the Figures.

Mr. Hilton has a warehouse, to the cellar of which there is no access, except by means of a step-ladder; and the difficulties which were experienced in storing casks of wine in it, induced him to invent the ladder-crane described below. It has been in constant use ever since, is cheap, not liable to be put out of order, and by means of it, one man can lower a hogshead of wine into the cellar, and two men can raise it out again.

In plate I., fig. 14 represents the crane, as fitted to a cellar, *g g*, part of the cellar floor; *h*, the upper part, opening to the street; *i i*, the ladder, having projecting ridges or ways *j j* on each side, for the platform *k k*, on which the goods *l* are placed, to traverse, by means of two friction rollers *m m* under it, which bear against the front *j j* of the ladder, and two other friction rollers *n n*, which bear against the back or underside of the ridges *j j*, and hold like a hook, as they turn on studs, fixed to the side bars of the board *k*. These friction rollers are so adjusted to the slope of the ladder, as to keep the board *k* level, while the weight keeps the rollers always in contact with the ways *j j*. Fig. 15 is a horizontal section of the ladder, showing how the ridges *j j* are placed between the rollers. The board *k* hangs on two ropes *p p*, which are made fast to its under-side, and pass over two wide pulleys *o o* at the top of the ladder (shown in section, at fig. 16, and in a front view, in the additional portion of ladder, fig. 17) and then descend to the barrel *g*, placed across the ladder-back; the barrel of the crane is turned by its toothed wheel *r*, and the pinion *s*, placed on the off side of the ladder, and is turned by the winch or handle *t* on the near side. The barrell has a ratchet-wheel and click *v*. A brake wheel may be applied to the side of the wheel *r*, or to one on the pinion axis. If goods are brought upon a truck, the platform may be lowered to the dotted lines *k*; but if received from the floor, the ladder may be sunk into a hollow *u u*, large enough to receive the platform *k* upon a level with it. When it is desired to raise goods to a cart, or to receive any therefrom, the additional portion of ladder, fig. 17, may be placed upon the top of the ladder; its iron bars *w w* fit into the iron staples *x x*, as shown by the dotted lines in fig. 14; but previously, a sufficient portion of rope to reach over this addition, is to be let off from the barrel *q*, it being taken from the lower pulleys *o o* to pass over the upper ones for this purpose. The pulley-frames are left open at top; but where this additional ladder is not used, they may be covered by the step *y*, joining the side of the ladder.

VI.—*On Introducing into use the Roots of the Stachys Palustris, as a New Esculent Vegetable. By* JOSEPH HOULTON, *Esq.*, F. L. S.*

11, *Grove-place, Lisson-grove.*
January 28, 1828.

SIR,

I OBSERVE in the list of premiums offered by the Society of Arts, that one is for introducing new and useful vegetables.

I have therefore the honour to submit to the consideration of the Society a specimen of an esculent which I call *panace*. It is the cultivated *panax coloni* of the older botanists; the *stachys palustris* of Linnæus, or March-allheal.

---

* From Vol. XLVI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its silver Ceres medal to Mr. Houlton.

The roots of this plant, taken up in December and January, are from six to ten inches in length, and when boiled, are similar to asparagus in flavour; they are very tender, having no hard fibres, and require boiling but from twelve to fifteen minutes to render them fit for the table; in the raw state they are very brittle, and free from any unpleasant flavour.

The cultivation of the plant is very simple, and attended with comparatively no expence, and it produces plentifully. Being indigeneous it is easily obtained.

In the month of March the roots should be taken up, and they must be divided into portions, each containing two or three joints. These should be planted not less than twelve inches from the surface, in a light rich soil, and in a moist situation.

From the observations I have made upon the vegetable for two years, I believe the size of the roots might be much increased by careful cultivation.

I have sent specimens of the root, which I have this day taken out of the ground, and put into vinegar.

I shall be happy to lay before the committee fresh specimens, that they may be more able to judge of its merits.

I am, sir,
Your most obedient servant,
JOSEPH HOULTON.

A. AIKIN, *Esq.*
Secretary, &c. &c.

The *stachys palustris* is distinguished from other species of this genus, by its moniliform tuberous roots. These begin to be formed in the middle of summer, and their growth is completed by the time that the herbage dies down in October. At this time the tubers are solid, their joints are roundish, and two buds, one on each side, are seated at the top of each joint. In the month of March the tubers begin to lengthen, they become hollow and stringy, and finally resemble compressed straws, all their nutritive particles being expended in the roots and stems.

The natural class of plants (the ringent) to which the genus *stachys* belongs, and which is included, for the most part, in the *didynamia gymnospermia*, of Linnæus, contains many species that abound more or less in fragrant essential oil, and are therefore frequently made use of as condiments in human food; such are all our common pot-herbs —mint, thyme, balm, sage, &c. No species of this great natural order has as yet been found to be poisonous; and none, with the exception of that which is the subject of the present paper, has been found to contain, in any sensible quantity, farina, or other matter nutritive to man. A very good figure of the plant is contained in Curtis's original *Flora Londinensis;* and Dr. Withering, in his "Botanical Arrangement," second edition, after describing the species, observes, that the roots, in times of scarcity, have been made into bread, after (it may be presumed) having been dried and ground to powder. Mr. Houlton's application of it as an esculent root, is, on every account, better than making it a substitute for flour; and the number of our winter vegetables for the use of the table being but small, it is not unlikely that this plant will be found a welcome addition. It grows with most luxuriance in light moist loam or silt; and it is probable that the more marshy parts of Battersea Fields, and other similar situations, which now produce little else than the yellow iris, and weedy herbage of the coarsest kind, may be profitably cropped with the *stachys palustris.*

VII.—*On the Power and Usefulness of Drawing. By the late* Edward Dayes*.

In this Essay we have two objects in view: to show the connection of drawing with painting; and to exhibit, in as clear a manner as we possibly can, its usefulness and influence on society.

---

* From his "Essays on Drawing."

Before we proceed however, it may be necessary to observe, that those who question the utility of the arts, would be equally disposed to question the utility of these Essays, that treat about them. Of their usefulness we hope to be able to offer numberless proofs; but they rise superior to the merely useful; for that which is necessary, is neither ornamental nor elegant; because necessity implies poverty, while ornament implies abundance. Hence architecture, as an art, does not apply to mere house-building.

In defence of these Essays, they are serviceable by exhibiting the usefulness of truth; and so far they become an object to all those who wish to become acquainted with the subject handled, and to obtain a knowledge therein. But to those who never think, or inquire, or concern themselves with matters of speculation, or who take up with speculations without examining them, or read only to confirm themselves in such as they have received, not any thing can become an object of concern, nor any book be useful.

That man was not intended for purposes base and ignoble none will deny; and if arguments were wanted, they might be drawn from that eternal inquiry after whatever is grand, dignified, or exalted; and finally, after a state superior to our present terrestrial one. For it is not too much to assert, that we approach the Divinity in nothing so much as in wisdom. Hence as the arts are connected with wisdom, as men become careless of their culture, they become equally incapable of filling the duties of social beings. For knowledge is what humanizes mankind; reason inclines them to mildness, but ignorance generates prejudice, which eradicates every tender feeling.

What has been the fate of those people whose lawgivers forbid the practice of this noble art? It appears they well knew, that where art resides, wisdom will ever be of the party; and they dreaded the downfall of opinions built upon a false base. What was the fate of Crete, that was so renowned for her wisdom, valour, and laws? How did she sink under the tyranny and oppression of Rome? With the loss of liberty we lose all the ardour nature has furnished us with to strengthen and support the flame of genius, and the ardent glow of valour; without it we become destitute of vigorous resolution, and sink below the natural virtue and dignity of our species. The wealth of a state, and the degree of civilization of its inhabitants, are shown in the perfection of the elegant arts; no country ever flourished without them.

Wisdom is power, and power is what preserves a nation; hence those who shut the door against knowledge are wilfully seeking their own destruction; such is precisely the present state of the Turkish empire.

> Ye God! what justice rules the ball!
> Freedom and arts together fall;
> Fools grant whate'er ambition craves;
> And men once ignorant are slaves.
>
> POPE.

The arts have not only an influence on our manners, but also on our passions, and taken in a national point of view, are highly useful. The pictures representing gallant actions, rouse and stimulate to acts of heroism public spirit; while those of a more elegant turn, exhibit examples of graceful address, and incline the mind to acts of beneficence and virtue.

Drawing may be said to possess a divine virtue in its creative power, and to be a perpetual miracle, as it preserves the images of distant objects, and the likenesses of those we love. Without risking our lives on the boisterous ocean, we may enjoy at home, in a small book, representations of the finest productions of nature and art, though situated in the remotest regions in the world.

By *drawing* is meant the exact imitation of all the forms and manners which present themselves to our sight; and in knowing how to give every thing in its proper and corresponding character agreeably to the subject, consists the excellency of what the artist terms *a good draughtsman*.

Drawing, as far as it is connected with mere imitation, is a mechanical operation, and may be acquired by persons of very moderate talents. So may a knowledge of bodies, properties, facts, events, and fables, by reading; but the powers of invention, the *vis poetica*, which distinguishes the bard from the mere versifyer or journalist, the genius from the mere imitator and copyist, must be a gift from heaven, bestowed at the formation of the being. Neither this poetic energy, nor the inventive powers of the artist, can be taught in schools or academies; but they may be buried in rust and inaction, if proper objects are not presented to call them into motion. So the inventive powers of genius will be futile, if unaccompanied by a skill in drawing. Without this, the learning of the painter or sculptor cannot be shown to advantage; it is the *sine qua non* by which all the other accomplishments are displayed.

From what has already been stated, the dependence of painting on drawing must be obvious; but how limited must their ideas be, who consider this as "the foundation of painting" only! We know it is such; for without drawing, it would be in vain to think of producing an effect; as mere colours without form, must remain a crude and undistinguishable mass; yet it has far better qualities than this.

Drawing is not only an accomplishment the most elegant, agreeable, and ornamental, but at the same time, that it is the foundation of painting, is of the utmost utility to the sculptor, the civil and naval architect, the engraver, the engineer, the mathematician, and navigator. It also assists the gardener, the cabinet-maker, the weaver, &c. In short, there is scarcely a branch of civil society that is not indebted to it, from the maker of the iron rails before our house, to the tea-urn on our table. To it we are indebted, for representations of those elegant remains of antiquity, that have contributed so much to the advancement of our knowledge of fine form. Volumes of verbal description will never convey so true an idea of a thing as the most slight sketch. Hence the source of much of our knowledge in antiquity, of which language could convey no adequate idea. To speak of the power of drawing in a very limited point of view, without it we could not have maps and charts; without them we could not navigate, we could not possess the advantages of commerce. Its application to ship-building must be obvious, as every part is made to scale. As a mere power of imitation it unquestionably sets a man at the head of creation, no other animal having made the attempt.

To be able on the spot to make a sketch of a fine building, beautiful prospect, or any curious production of nature or of art, is not only a very desirable and elegant accomplishment, but in the highest degree entertaining. To treasure up whatever may occur on our travels, either for future use, or to illustrate conversation, to represent the deeds of the great of former ages, and to preserve the features of our most valued friends, has made this art not only one of the highest embellishments of our nature, but the delight of all ages. The greatest have united to praise, and empires to encourage it. It has been in the highest degree morally useful; and where it has flourished, conferred honour on the country. In fact, society could not sustain a more severe loss than in being deprived of it; as many comforts, and all those elegancies that adorn the present state of our being, must depart with it.

No one can possibly judge of his powers from mere speculation; the test must be applied before the value of the gold can be known. Nor will inactivity ever discover how far our fortitude will enable us to overcome difficulties, our patience to bear disappointment, or our industry enable us to range the wide field of art. The axiom so necessary to be remembered that, were the arts of easy attainment, they would be unworthy the notice of a great mind, should induce us to increase our exertions, in proportion to our disappointments; recollecting, that to strive with difficulties is noble; but to conquer, is one of the highest points of human felicity. It is in painting, as in writing; where difficulties occur, they arise from our not clearly understanding the subject. Hence, to be able to represent an object justly, we must understand its fabrication; for it would be vain to think of drawing the arch of a bridge correctly, without knowing how it was keyed or put together; or even a basket, if we did not know how it was woven.

Among the number of our own national advantages, and which some may think superior to all others, we may observe, that the excellence of our artists has turned the balance of trade in our favour. For though we formerly imported vast quantities of prints, we now supply all Europe, and import very few. Even for the decorations of our books, we were formerly obliged to apply to strangers; but Heath has added a taste to that department of art, unknown to former engravers in the historical line; and among the topographical publications, many of those prints that accompany the "Beauties of England and Wales," must be highly interesting for taste and beauty.

In the beginning of the last century, the writers on the continent amused themselves in endeavouring to assign a cause for the dulness of us islanders, in not having produced one historical painter. Our northern latitude, being involved in fogs, was among the reasons assigned. But the causes of such absurd inquiries have ceased, and the mental capacity of Britons no one will now dare to question.

The consequence of our nation and the arts appear to have advanced together. The first is evinced in our colonial possessions; and if we go back to the time of Henry the Eighth, we shall easily discover the state of commerce, and the comfortless state of society at that period, compared with the present. Hollinshed observes, that chimnies were a novelty, as were pewter ornaments for the table. Straw formed the bed, and a good hard block of wood the pillow. Then was the dawn of the arts. Since which time they have been advancing; and are now, thank

God! matured into a glorious mid-day, under the auspices of our late King, and his present Majesty.

It is impossible to speak of the arts without expressing our gratitude towards their great patrons; and were his name to flourish in no other way, that of George the Third will be sacred to posterity with those of Leo, Julius, and all such as have a claim on eternity as the protectors of art. His late Majesty did for the arts, what no Monarch of this nation ever did before: he gave, by his patronage, a turn to the national taste, highly beneficial to the profession, which the public are bound to support by a liberal and fair encouragement. With respect to the mere act of buying, we are bound to consider his late Majesty in the light of a private gentleman, who regulated his expenditure according to his income; and we ought to thank God that it was so.

Holbein had not taste enough to change the grotesque fashions of the court of Henry the Eighth; he brought about a revolution in architecture, but he introduced a mongrel style, inferior to the gothic of that period. Zuccaro was in England in the time of Elizabeth; and during that long reign we find little improvement in architecture, dress, or in the general circle of elegancies; it was a court of intrigue and vanity. In the reign of James the First, Van Somer and Cornelius Jansen paved the way for Van Dyk—an epoch of taste; but this appears to have been confined to the court and a few noble collectors; and the troubles of Charles, his successor, prevented his giving them a more general influence; yet his reign stands high in the history of architecture, from having produced Inigo Jones. Under Lely, taste sank into Indian gowns and flowing perukes; till fashion became a monster in the time of Kneller, and appeared in buckram coats, square toed shoes, and disproportioned head-dresses in the ladies. This style of dress prevailed till within these few years, when good sense, and a more just taste, broke through the buckram and whalebone, and produced the present easy and elegant mode of attire; which may be said to mark a point of national excellence. Reynolds contributed much to this change; his whole life was a struggle with the hydra fashion, as his works evince.

The above statement will be found not only to apply to the article of dress, but to extend to every department. Let us, for instance, from the period of Henry the Eighth, examine ship-building and civil architecture; our furniture, plate, &c., and we shall find them to have improved together, or to have fluctuated as the taste for *dessin* prevailed; till the patronage bestowed by his late Majesty, by exciting a love for the arts, improved the national taste to its present great and highly respectable state.

However much we may lament that historical painting is not sufficiently encouraged, yet we must dissent from those who support the old but erroneous opinion, that our love of portrait painting arises from a national vanity. This ridiculous idea has been bandied about, both by foreigner and native, till many, who take up with opinions without examining them, have believed it true. We boldly assert, on the contrary, that it is national virtue that gives it birth; and a desire the most rational, that of preserving the images of those we love and delight in constantly before our eyes. It argues great national beneficense and goodness of heart. We may in some measure judge of the disposition of the master of a house, from the number of portraits he possesses; they cannot be likenesses of his enemies. Hence his choice must be founded on love; and not as the ancients was, on pride and vanity. The portrait painter therefore becomes morally useful, by increasing that social tie that binds society together, in keeping before our eyes the images of departed worth, or of existing merit, It is only those who neither love, nor are beloved, that have no need of the portrait painter.

Before we dismiss the present Essay, we shall endeavour to point out some of the advantages that result from the practice of drawing, to those who do not make a profession of it. Many must be obvious from the former part of this paper. To every gentleman who travels it is absolutely necessary; for independently of its teaching to see accurately, the curious and ever-restless eye of the artist comprehends more at one view, than the common observer will notice in an age. The volume of nature is laid open to him; his attention is directed alike to the vast and to the minute; men and manners are not concealed from his view, and his imagination clings to perfection with ineffable delight.

It is not too much to say, that drawing opens the mind more than years devoted to the acquiring of languages, or the mere learning of words; it teaches to think. The artist is a true logician; not content with producing effects, he is ever inquiring after causes founded on a visible demonstration, to exhibit them in his own works.

We must not rank it amongst the least of the advantages resulting from the practice of the arts, that it inures the reflecting mind to the most enticing sort of logic. The practice of reasoning upon objects in themselves agreeable tends to produce such a habit, and habit strengthens the reasoning faculties. Besides, while the mind is engaged in obtaining knowledge, we escape the insipidity and indifference connected with inactivity. Hope attends labour; a blessing unknown to those who live lazily on the toil of others. The sensualist imagines he enjoys the world, because he eats and drinks, and runs about upon it; but to enjoy it truly, is to be sensible of its greatness and beauty.

Independently of keeping the mind employed, the arts contribute to harmonize the temper; and the power of drawing brings with it so much mental enjoyment, that youth, in order to be occupied, is not tempted to precipitate into the ruinous and destructive vices of gaming and drinking. It defends us in the meridian of life from the wild schemes of ambition; and in all ages it becomes a sure shield against avarice. Shenstone observes, " Where there is a want of taste, we generally observe a love of money and cunning."

The influence it has on our moral conduct, is perhaps one of the greatest recommendations to the study of the arts. No one can meditate on the order observable in nature, and not reduce his conduct to a similar standard of regularity. To have a just relish for what is proper in painting, sculpture, or architecture, must be a fine preparation for true notions relative to behaviour. Should such a one be overpowered by passion, or swerve from his duty, we need not fear but he will return on the first reflection, and with a redoubled resolution not to err a second time; for he cannot but observe, that the well-being of nature, as well as of the individual, depends on regularity and order; and that a disregard of the social virtues, will ever be accompanied with shame and remorse. Passion is a whirlwind, that shakes the human frame, as the convulsions of an earthquake disorder that of nature.

Every Briton that travels should propose to himself pleasure and advantage, and his inquiry should enable him to add to the national stock of knowledge; for it cannot be said that he travels to enjoy the advantage of a better government, or because other nations have a better commerce. Hence then it must be for arts and learning. And how is he to become acquainted with the former, without a knowledge in painting, sculpture, and architecture; any more than he could in the latter, without a knowledge in the languages of the countries he may have to pass through? Lord Bacon says, "Travel, in the younger sort, is a part of education; in the elder, a part of experience. He that travelleth into a country before he hath some entrance into the language, goeth to school, and not to travel." The same may be said of those who travel before they have obtained a knowledge in the polite arts. How many noble works of architecture did Lord Burlington bequeath to his country! They remain monuments of national taste, highly honourable to his country.

While we are recommending to gentlemen to learn to draw, it must not be understood, that we wish to deprive the ladies of the pleasure and advantage that must result from their practising an art, that contributes, perhaps more than all others, to improve our taste; and particularly in such things as are connected with decoration.

Though we recommend learning to draw thus generally, we must say it requires the utmost caution in the choice of a master; for should his abilities be confined, or his taste depraved, there is great danger of the poison being conveyed to the pupil; and if in the end his better understanding rise superior to the evil, he will, unfortunately, have much to unlearn. Above all, if he be arrived at an age to discriminate, objects worthy attention should be set as examples of imitation; he should not be amused, and his time wasted, with ge-gaws and trash, beneath the dignity and attention of rational beings.

Every one is acquainted with the progress of what may be termed common or school education. The masters begin by teaching the letters, and then proceed to syllables, which are joined into sentences; but the ultimate end is, composing themes, to call forth the power of invention, and convey a more exquisite idea of the language. Exactly so should be the progress in teaching drawing. If the knowledge to be obtained be the human figure, we begin with parts; as eyes, noses, heads, hands, &c., which are the A B C. This, of course, leads to the whole figure, which may be compared to spelling; that naturally conducts to the round, or drawing from plaster casts; then from the life; and ultimately to composition. Should landscape be the pursuit, the progress is precisely the same. We begin with parts, or single objects; as trees, bridges, cottages, castles, &c. Here again is the alphabet. This too we quit to copy wholes, or a combination of objects; and in the end we apply to nature, which sets us free from our master. Then we must improve by our own activity; and like the bee, cull the honey from every flower. As much of our success depends upon the abilities of the master, the greatest care should be observed in the choice. He is, indeed, but as a crutch to the lame; but we ought to make ourselves sure that it is sound, and without flaw or shake, that is, as far as our judgment will permit, or the opinions of friends direct.

He who aspires to a knowledge in the fine arts, can only hope to succeed, by turning his attention to the sensitive parts of nature, particularly by an inquiry after such objects as are naturally agreeable, or the contrary; also such as are grand or mean, proper or improper. This is the only foundation of a just and rational taste; and like morals, may be cultivated to a high degree of refinement. The fine arts, where the feelings only are concerned, will please from their novelty, in the prime of life; but the delight will cease in a more advanced period, when the fervour of the imagination goes off. On the contrary, where we are governed by just principles, and a thorough knowledge, they will afford scope for fancy as well as judgment; they will grow into a favourate entertainment, and their vigour will prevail as strong in the evening as in the morning of life. This only can make the arts truly delightful. It is not a few technical phrases, picked up from professional men, which may enable one to babble like a parrot, that can at any time please or be pleasing. Science is a very coy lady, and will not grant her favours without being long courted. But should we aspire to no higher character than that of the mere critic, a small stock of information will suffice; and practice will increase confidence, where there is nothing to lose. Criticism is a lady of easy access; the want of meaning she supplies with words; and the want of knowledge is recompensed with cunning. She flatters all; and those whom nature has made weak, or idleness keeps ignorant, may feed their vanity at her shrine.

Genius has been compared to fire from flint, which can only be produced by collision; if so, success must follow where nature directs, and perseverance attends. Activity is a necessary ingredient to enable us to obtain a knowledge in art; and should we find others out-step us, let us redouble our diligence; and comfort ourselves with the reflection, that a late spring produces the greatest plenty.

> "Explore through earth and heav'n, through sea and skies,
> The accidental graces as they rise;
> And while each present form the fancy warms,
> Swift on thy tablets fix its fleeting charms."
>
> MASON'S FRESNOY.

VIII.—*On the Nitrates.*

(Continued from vol. IV., page 393.)

The principles upon which Mr. Riffaut's method of essaying are founded, equally serve as the basis of the processes which were formerly employed in the purification of the rough saltpetre, they being founded on the difference in solubility of the nitrate of potash, and of the chlorates *(oximuriates)* which accompany it; a difference, which is inversely, as we operate in the heat or in the cold. We then, in order to obtain a high degree of purity in the rough saltpetres, submit them to preliminary washings with small quantities of cold water, which extracts the chlorates. In order to this, we distribute the saltpetre into small conical strainers of coarse linen or sackcloth, placed in hoppers, with double bottoms to them, of which the first, that is the inner one, is pierced with a great number of small holes, to facilitate the escape of the water. We then pour into each strainer, by means of a watering-pot, the first portion of water, equal to about fourteen-hundredths of the salt contained in it; and when this first washing is completed, we proceed to a second, and then to a third; but this last is done with only six-hundredths of water. The waters from the second and third washings are reserved, to be employed for the first washing in the subsequent operation; and the first washings are added to the *eaux de cuite.*

Now, however, instead of applying these washings to the rough saltpetres, we do not employ them till they have been submitted to a re-crystallization; and indeed we cannot even sometimes avoid a third crystallization, which is strictly necessary, when we would obtain a saltpetre fit to be used in the manufacture of gunpowder, for the purposes of war. This method, which is also much more expeditious, we owe to Beaumé and Lavoisier; and it rendered important services to France when surrounded with enemies; and it was necessary to have recourse to its own natural means, to supply the multiplied demand of its numerous armies.

It is this mixed method which is actually employed in the Arsenal at Paris. The following is the process:—They commence by putting into a boiler 1200 kilogrammes of rough saltpetre, and gently heat it for twelve hours, in order that the mixed salts may dissolve according to the respective order of their solubility; at the end of this time, and when the water is become so saturated with nitre, as to be no longer capable of dissolving the chlorates, they increase the heat, and add by degrees 2400 kilogrammes more of the rough saltpetres, they then push it on to ebullition; they also stir it with an iron rake, remove the scums which form upon the surface, and withdraw the chlorates which are deposited; they then pour in a little water, to abate the ebullition, and add a kilogramme of Flanders' glue, which had been previously dissolved in warm water; they then again stir it up, or agitate it, scum it, and finally pour into it 400 kilogrammes of water, to reduce it to a convenient degree of concentration. When no more scum arises, and when the clarifying it is finished, they withdraw the fire, and when the temperature is lowered to about 88 degrees*, they pass the solution into a crystallizing vessel, whose bottom is formed of two inclined planes, meeting in the centre, so as to form a gutter in the middle of it. In order to hasten the cooling, and disturb the crystallization, the workmen are furnished with long rakes, or beaters, with which they agitate the liquor incessantly; and in proportion as the salt crystallizes, they raise it by means of the rakes, to the higher parts of the inclined planes, in order that it may drain. This operation generally lasts for six or seven hours for the proportions we have above indicated. When it is finished, they remove the drained salt with shovels pierced with holes, or scummers, and deposit it in the frames ready to be washed. These frames have their bottoms pierced with a great number of holes, as we have before mentioned, but which are closed with pegs. They then dash upon the salt a certain quantity of water saturated with nitre, and agitate it from time to time, continuing the maceration for three hours; at the end of this time, they remove the pegs from the holes, and leave the salt to drain. They then again close the holes, and proceed to a second washing, but with pure water; and after three hours longer they again drain it, and they do not cease to wash it with pure water, until the water which drains from it, is precisely of the same density with a saturated solution of nitre, at the temperature of the room. The salt being by this time well washed and drained, is finally put into a basin, and slightly heated; being also continually stirred with wooden shovels, that it may not attach itself to the sides of the vessel or the utensils; and is then placed on a sieve of brass wire, ready to be barrelled.

---

* Of the centrigrade thermometer.

As for the mother-waters, and those from the first washings, they are treated just in the same manner as the *eaux de cuite.*

France collected annually, by this process, when the wars were most active, near two millions of kilogrammes of nitre, proper for the manufacture of gunpowder; and the manufacturers of Paris alone furnished seven-twentieths of this quantity.

In those places where they could not find the natural materials for making saltpetre, they were obliged to have recourse, as we have before said, to those which they termed *artificial nitre-beds*; that is to say, they united and placed under the most favourable circumstances, the various elements which are indispensable to the formation of nitre; and this requires us to make known the theoretic considerations which should guide us in the formation of these artificial nitre-beds.

It has been generally observed, that the materials for making saltpetre, are more particularly to be met with in low and moist dung-hills, and especially those which are composed of the refuse of a great variety of animals; such as those of stables, cow-houses, and sheep-folds. And also, on the other hand, that the nitric acid, and all animal substances, have one common principle, which is azote; and hence we have concluded, that these azotic organic substances, were indispensable to the formation of saltpetre; it is also equally known, that the nitric acid is not formed spontaneously; but that when we present an alcaline or an earthy base to it, it instantly contracts an intimate union therewith; and likewise, as humidity is, as one may say, the vehicle necessary in all chemical combinations, so it will account for the more facile nitrification which takes place in the lower parts of habitations. But the atmospheric air also performs an important part in this operation; and we know that it is indispensable that it should penetrate into and remain mixed with all the materials; but we are still ignorant of the true cause. Nevertheless, some chemists, and particularly M. Longchamp, pretend that it is this elastic fluid only, and not the organic matters, which furnishes the elements of the nitric acid; and in fact, that it is nearly entirely composed thereof. On the other hand, we can also supply facts equally notorious; and although indeed it is true to say, that places inhabited by animals furnish much saltpetre; yet we must also add, that in India, Spain, and other countries, immense quantities of saltpetre are formed, far remote from any habitation. It therefore yet remains for farther experience to pronounce between these two contrary opinions; but we must believe that Nature, without being confined within the narrow limits we seek to enclose her in, frequently employs different means to attain the same end.

However this may be, amongst the various data which direct us in the formation of artificial nitre-beds, there are some which are founded upon the idea, that azotic organic materials are indispensable to the formation of the nitre. The following are the rules established in this respect, or at least they are those which are recommended by the Consultative Committee of the Gunpowder and Salpetre-works, as being the most favourable for the success of those undertakings.

The permeability of the materials to the atmospheric air, was acknowledged as an indispensable condition, as well as the presence of a base, capable of fixing the nitric acid, in proportion as it was produced; and they commenced by selecting a light earth, containing the most possible of the sub-carbonate of lime; and when they could not meet with such, in that case they composed one artificially, by mixing with a light earth, ashes, rubbish of old buildings, &c.; and where they had the facility, they stratified this mixture with layers of dung, of five or six inches in thickness, and which they also sprinkled, from time to time, with water from the dung-hills. When the whole appeared to be converted into a species of mould, it was spread under sheds, in layers of two and a half, or three feet in thickness; these they continued to water with the drainings from dung-hills, and urine; but always took care not to add either too much or too little moisture; neither did they lose sight of the necessity for the mixture being always permeable to the air; and yet, nevertheless, that it contained a sufficient degree of humidity to favour the combinations which they would produce. Thus they took as a type of the convenient degree, that which prevails in the soil of well cultivated gardens. They were also advised to mix and turn over the beds at least twice a month, and to keep the shed partly closed; but so as that the air which is necessary might have access, but that it should not circulate in too great abundance, in order to avoid a rapid evaporation, which is always hurtful. The re-action which is thus produced on the materials, is slow and gradual; but it cannot be affected at all, without an alternate state of rest, and that for a long continuance.

The whole process lasts about two years; but as the organic materials furnish in washing many soluble substances, which hinder the extraction of the nitre, so they cease to add any more in the last six months of the work, but only sprinkle the beds with pure water; the re-action thus continues the whole time, and the organic matters finish, in being totally destroyed.

The Consultative Committee advise, when they cannot command a sufficiently large quantity of dung, that the nitre-beds be established in a cow-house; and in order to do this, after having made a convenient excavation, they place the prepared earth in it, in the manner we have above described, and then cover it with a sufficient thickness of litter; and after leaving it for four months, to raise the litter, and turn the earth over, and then to cover it with a new layer of earth, of the thickness of eight or nine inches, upon which they are again to spread the litter. Four months afterwards they are to repeat the same operation, and then leave it to re-act for four months longer; and it is not before this third treatment that the earth should be removed to the shed, and where the nitrification must be continued according to the method we have before indicated.

The low price at which saltpetre is obliged to be sold, added to the small quantity which can be obtained by this process, and the long time which they are obliged to wait, does not permit any one to speculate with advantage in these kind of works; as the interest on their capital alone, which they are obliged to employ, would be with difficulty compensated by the intrinsic value of the products. We therefore think that no one will undertake this manufacture but upon a small scale, and without any expence, and only as annexed to others; and it is thus that it is made in Sweden. There the simple peasants only occupy themselves in this kind of work, and every one has, as we may say, a nitre-bed, which is formed in a small wooden cabin, the soil of which is composed of beaten clay, and is covered with ordinary planks; over this he spreads a mixture of common earth, of calcareous sand or marle, and washed wood-ashes; he sprinkles this mixture with the urine which drains from his stables. He renews the surfaces once every week during summer, and every five days in winter. To facilitate the process, he provides small spaces against the sides of his cabin, and throws the earth on the side opposite to that from which he had brought it, and takes care not to heap it above two or three feet in thickness. This bed extends the whole length of his cabin, and which is provided with shutters, to prevent the rays of the sun from entering it.

When, for the sake of economy, or any other motive, the nitre-beds, as in some countries, are formed in the open air, they make a mixture of earth and dung, as in other cases, but they likewise add the stems and branches of herbaceous plants, in order to give them solidity, and yet permit the air to penetrate between the layers. They construct with these materials walls of two or three feet in thickness, and about six or seven in height, and shelter them with roofs of straw. These walls, which are generally placed in such a manner as to present their broadsides to the rain, are likewise sprinkled, but with water which is but little rich in organic substances. One of the two broad faces of these walls remains plain; but the other, which is the only one that is sprinkled, is formed into steps, in order that the moisture may penetrate, and be distributed uniformly through the whole substance of the wall. The nitre effloresces upon the plain face of the wall, and can be readily collected.

It is almost needless to observe, that whatever method may be followed in the conducting of these artificial nitre-beds, we must, in order to know when the materials are become sufficiently rich to be worked, follow the method we have before indicated, as practised in the working of the saltpetre materials in France.

M. Longchamp, under the conviction that organic substances do not at all contribute to the nitrification, proposes to omit their employment entirely, and thinks that we should find in suppressing them a double economy; and especially, as in avoiding an expence, which he deems superfluous, it would be proper for the master to establish his works in those localities where he might procure labour at a low price, as well as combustibles and materials for buildings.

He proposes, in consequence, to erect artificial nitre-works in the midst of forests; and these he advises us, as much as posible, to choose in places where the soil is dry, and a little elevated; and then to trace out a square of from 200 to 300 metres on each side, in the middle of which he would construct a graduation house, and by the side of this a second, in which he would establish the furnaces and boilers, intended for the evaporation of the waters. Against the four sides of the principal building should be placed, what he terms, the *hangars nitrières* (or sheds where the nitre is made) of 40 metres in length, and eight or ten wide; in these the washings are to take place, and all the waters are to be conveyed away through conduits in the foundation of the graduation house. These sheds are to be enclosed in walls built in *pisé*, and to be covered with stubble.

Amongst all the substances proper for nitrification, there is none more favourable than the natural stone, known by the name of *tufa*. M. Longchamp advises us always to have recourse to its employment in those localities which permit it. This stone, says M. Longchamp, becomes nitrified with such facility, and so abundantly, that in

Touraine, where this stone is used to build with, the makers of saltpetre re-build foundations at their own expence, in order to have the liberty of removing the stones which are thus nitrified,

Tufa is no doubt proper for this use, not only from its chemical nature, but likewise from its texture, which is composed of large and homogenous pores; and which affords both to elastic fluids, and to humidity, an easy entrance. And thus we should at all times endeavour to procure the chippings formed in squaring these stones, and construct with them and other rough stones, walls of 50 centimetres in thickness; always following, in regard to their exposure and their sprinklings, the rules already prescribed; and in default of tufa, we may make a mixture of earth from the fields, of sand, and of pulverized chalk, to which we may add a tenth part of tufa where it is abundant, or less in the contrary case. But instead of chalk, which has a tendency to give the mixture a calcareous hardness, M. Longchamp thinks that we may with advantage employ lime, which has been slaked in the open air, to mix with the other materials. We think that the chalk might also be re-placed by a chalky marle, but we should take care previously to expose it to the open air, in order to make it crumble to powder. In all these mixtures we must not lose sight of the two essential conditions, which must be fulfilled, in order to their facile nitrification; namely, that they possess a great permeability on the one hand, and that they afford a calcareous base on the other, in such a state of division, as to admit of an immediate combination of the nitric acid to take place, in proportion as it is produced. For the rest, we advise those who desire more details of this new method of nitrification, and in the conducting of new artificial nitre-beds, to consult M. Longchamp's Memoir, which is published in t. XXXIII. *des Annales de Chimie et de Physique.*

Whatever might have been the origin of the nitrate of potash when it is pure, it possesses the following properties:—It crystallizes in long hexahedral prisms, terminated with pyramids of six faces, but which are rarely regular and transparent; it is more generally an agglomerate, formed of a great number of crystals, and which also appear channelled or striated. The prisms sometimes become very large, when they are termed nitre in rods; but as it is commonly preferred for general use in the arts, and for the facility of transporting it, to have it in more compact masses; so they disturb its crystallization, and obtain it in large masses; which, like sugar, take the shapes of the vessels in which the concretions are formed. The taste of nitre is cool, saline, and poignant, and it strongly excites the secretion of the saliva; it is very soluble in water, but more readily by the assistance of heat, than in the cold. M. Gayu Lssac has determined the degrees of solubility of this salt, for every five degrees of the centigrade thermometer, and has arranged them in the following table:

Temperature.	Quantities of Nitre dissolved in 100 parts of water.	Temperature.	Quantities of Nitre dissolved in 100 parts of water.
0°.0	13°.32	55°.0	97°.70
5.0	16.60	60.0	110.70
10.0	20.55	65.0	124.51
15.0	25.49	70.0	137.60
20.0	31.75	75.0	154.10
25.0	39.85	80.0	170.80
30.0	45.90	85.0	187.90
35.0	54.35	90.0	205.05
40.0	63.80	95.0	225.60
45.0	73.95	100.0	246.15
50.0	85.00		

Notwithstanding the great affinity of nitre for water, it nevertheless scarcely contains any when it is well dried.

Alcohol, when pure, does not dissolve it in the least.

Submitted to the action of heat, nitre enters into a tranquil fusion, and after having lost the small quantity of water which it retained in its interstices, it constitutes, when it has been cast into plates, what is termed *crystal mineral.* Some manufacturers add a little sulphur to it before they cast it, and which then forms a small portion of sulphate of potash, which remains intimately mixed with the nitre.

If, instead of casting, or pouring out the nitre when it has entered into tranquil fusion, it be exposed to the action of heat, it will be decomposed, and at length disengage a certain portion of oxygen; but if the process be stopped in good time, the nitre will be found to be converted into the hyponitrate of potash. If, however, we continue still to heat it, the remaining acid will be completely decomposed, and we shall collect the azote, the oxygen, and, lastly, the nitrous vapour, nothing remaining but the potash; but before we attain this point it will require a very long time, as the last remains of the acid adhere strongly to the base; and if the decomposition be effected in vessels susceptible of being attacked by the potash, such as those of glass, the decomposition will be effected more quickly indeed; but instead of obtaining pure potash, we shall then procure nothing but a combination of this alkali with the earthly oxides, which entered into the composition of the vessel.

It was upon this property that was founded the ancient process for extracting the nitric acid; a process which was followed until only a few years since, and indeed is still practised in some places. They made a mixture of dried clay and nitre, and then heated it. The alkali, from its tendency to combine with the alumine, the silex, and the lime contained in the clay, abandoned the nitric acid at a sufficiently low temperature, and the greater part of it was disengaged without experiencing any decomposition. We may consult on this head all the ancient works on chemistry.

We may easily conceive, after this explanation, that in default of alkali, we might make use of nitre in the manufacture of glass, enamels, &c.

When nitre is heated with different simple bodies, it burns, and there result products, which vary according to the combustible bodies. Thus sulphur is transformed into the sulphurous and sulphuric acids; azote and nitrous gas are disengaged, and there remains the sulphate of potash. We obtain a considerable advantage from this property in the manufacture of sulphuric acid, by the reciprocal action of the nitre and the sulphur upon each other: we make a mixture of eight parts of the latter article, and one of the salt, and heat it gently, and in contact with the air, and it produces nitrous gas, and sulphurous acid gas; but if it be performed in a leaden chamber, with the assistance of air and moisture, it forms the sulphuric acid.

If charcoal be substituted for sulphur, it produces carbonic acid, which at length combines with the alkali, and forms the sub-carbonate of potash; but to which has also been given the name of *nitre fixed by charcoal.* This process is sometimes performed, but it requires certain precautions to be taken, in order to avoid the accidents which might result from a too violent re-action of the materiaſs upon each other. Thus they generally use for this purpose a cast-iron vessel, the bottom of which is heated to an obscure red; into this they project, in small portions at a time, a mixture of three parts of nitre, and one part of pulverized charcoal; each time there is produced an instantaneous deflagration, with a brilliant light; and sometimes even a detonation, more or less violent, according to the quantity of the mixture thrown in.

Notwithstanding the violence of this re-action, all the parts of the mixture are not, however decomposed; and after the process is finished, a part of the nitrate, or at least of the hyponitrate, remains; and in order to attain an entire decomposition, the vessel is again made red-hot, and then the remaining acid, mixed with a little charcoal, is submitted to a new re-action, which entirely decomposes it. They wash the residuum, to separate any small portions of charcoal which may yet remain; and by evaporating the ley, they obtain the sub-carbonate of potash in a state of great purity.

More frequently, however, in order to attain this alkaline salt equally pure, and with less danger, they prefer to substitute the cream of tartar and charcoal, because both the salts have the same base; and the vegetable acid in the tartar undergoes a decomposition more slowly, and without being liable to the inconveniences which happen where nitre is employed.

When they fuse in a red-hot crucible a mixture of nitre and antimony, or its sulphuret, they then obtain the product, termed by the ancients, *diaphoretic antimony, unwashed,* but which is a combination of the protoxide of antimony and potash; but when the metallic antimony is used, and either the sulphate or sulphuret of potash, from this first combination two others are produced, by submitting it to a complete washing in common water; there are thus formed two new combinations, the one soluble, which contains alkali, and only a little oxide of antimony; and the other insoluble, which, on the contrary, contains a large proportion of the oxide, and only a little alkali; this is much used, and known by the name of *washed diaphoretic antimony.* If the washing waters be saturated by an acid, there will precipitate a white oxide of antimony, distinguished by ancient writers under the denomination of *the pearly matter of Kerkringius,* and also employed in medicine.

Arseniate of potash.—A salt, of which there is a great consumption made in calico-printing, where it is employed as a mordant. It is obtained by heating a mixture of equal parts of the white oxide of arsenic (the arsenious acid) and nitre. To manufacture this salt in the large way, they heat the mixture gradually in cast-iron cylinders; there are plenty of nitrous vapours disengaged; the arsenious acid passes into the state of arsenic acid, and the greater part of the residuum is an acid arseniate of potash, which is found mixed with a little arseniate of the nitrate and the hyponitrate. The whole is dissolved in water, filtered, and evaporated to a proper degree, and they then obtain the *arseniate of potash,* which crystallizes in fine, square, and very regular prisms; these are transparent, and are terminated by pyramids, with four faces.

We might also apply this property to profit, in separating arsenic from certain of its natural combinations; it will be sufficient to cite for an example, the arsenical cobalt, which contains, besides the cobalt and arsenic, a great quantity of iron; we mix the pulverized mineral with nitre, and heat it strongly in a crucible. All the metals are oxidized in succession by the decomposition of the nitric acid; and not only are they dis-united, but the arsenic, which passes into the state of the arsenious or arsenic acid, combines with the potash, and may easily be extracted, or at least the greater part of it, by simply washing it, and which will operate so as to separate the oxides of iron and cobalt from it.

There are also many other cases in which we may equally derive advantages from the action of the nitre, and the facile decomposition of its acid; and in order to afford one of the most familiar examples, we shall mention the *chromate of iron*, which, when properly treated with nitre, is converted into an oxide of iron, and the *chromate of potash*.

It is also by means of nitre that we refine, in certain cases, gold and silver, when they are found combined with more oxidable metals, as copper, iron, lead, &c.; when these are melted with this salt, and a little borax and common salt, they free them from the greater part of the other or baser metals.

The greatest consumption of nitre however, is in the manufactures of gunpowder, and of the nitric acid. The Government has, hitherto, laid considerable duties on the importation of foreign saltpetre, in order to encourage the manufacture of saltpetre in France; but there results a serious inconvenience from it, to all those chymists or manufacturers to whom nitre, or the nitric acid are objects of the first importance; and who are thus prevented from competing with the English manufacturers, who obtain their nitre at a much lower price. It is then hoped that the Administration, clearly seeing the true general interest, will renounce a monopoly, now become so prejudicial to a great many persons.

Nitre is employed in medicine as one of the best diuretics known; thus it is sufficient to add a few grains of it to any lenitive draught, to greatly increase the secretion of urine, in those maladies in which it it is employed.

We sometimes add a little saltpetre to marine salt, in the preservation of certain viands, and especially of pork, in order to give a red or rose colour to the muscular parts; this colour is pleasing to the eye, and serves also as a test of its good preservation.

Nitrate of Strontian.—This salt, for which a great consumption has now for some time been made by the manufacturers of artificial fire-works, in order to produce *red flames,* is produced in exactly a similar manner with the *nitrate of barytes*; and therefore that process may be consulted for directions concerning it.

We have, nevertheless, one observation to make, which is, that there exists two nitrates of strontian; one which contains forty per cent. of water of crytallization, and which takes the form of large transparent octahedral prisms; and another, which is anhydrous, and crystallizes in small opaque octahedrons, resembling the crystals of nitrate of barytes. The fire-work makers prefer the first kind of crystals, because they readily melt at a gentle heat, and they can then obtain a very fine powder, which readily mixes with the chlorate of potash and the charcoal, with which they are generally combined, in order to produce those fine red flames, which are now so much admired at all our theatres. R.

IX.—*On the Ill Effects of the Ranunculus or Butter-cup, and of the Poppy.* By *Mr.* CHARLES WHITLAW *.

"I WILL conclude my remarks on the properties of the *ranunculus* or *butter-cup*, by stating some experiments made in 1817, by a number of young medical gentlemen who attended my botanical lectures in the United States, in order to ascertain the specific action of a number of plants, containing acrid and corrosive poisons. Various trials were not only made on dogs and cats, both internally and externally, but three of the students made several upon themselves. The first individual was young, had flaxen hair, and blue eyes; he had lived principally upon vegetables, and was of an acid temperament of body. He applied a plaister made from the butter-cup to the fleshy part of one of his arms. In a short time the part was slightly inflamed, but the skin was not broken; these symptoms did not last long. The second person was very healthy, and had lived upon a proper mixture of vegetable food. He applied the butter-cup plaister about the same time in the evening as the other individual. In the morning five blisters were raised, and which, when discharged, were washed and dressed; they healed as well as those drawn by cantharides. The third person lived chiefly on butcher's meat, and was particularly fond of fat and butter. He had dark hair, grey eyes, and had a bilious appearance. He applied, upon going to bed, a plaister, made from the same mass as the other two were, to his leg, and found in a short time, that it had produced the most violent inflammation. He bore the pain for upwards of two hours, when it became so insupportable that he took it off, and he found the following morning, that a blister had been raised, had broken and discharged. The humour had corroded the skin as far as the plaister and ichor had extended, and a large ulcer followed. This we could not heal. It corroded the flesh to the bone, and emitted an ichorous fœtid discharge, resembling that from cancer. A number of medical men were of opinion that amputation must be resorted to in order to save his life. There were others of opinion that absorption had taken place, and therefore amputation would be dangerous. The inflammation was ascribed by the former, to the sympathetic action o the poison, and not to absorption. In this dilemma, I persuaded the gentleman not to submit to any surgical operation, but recommended him to take the advice of an Indian doctor. To this he assented; and the doctor, upon seeing the case, declared he could cure him, if he would confine himself to a prescribed diet. This was to consist principally of vegetables; and neither salt, spices, nor any heating substances were to be eaten. I could not at that time discover the nature of the herbs he employed; but with them he soon brought the ulcer to a healthy state, for it granulated and healed rapidly: thus showing the importance of a vegetable diet in cancerous cases. About a month afterwards, an eruption broke out in the second case, resembling chicken-pox; the vesicles filled, and discharged a matter somewhat resembling the small pox; and afterwards formed crusts or scabs. During the continuance of the fever, the inflammation had a dark red appearance, and the pustules were of a bluish colour, the largest of them having a tendency to ulcerate; but by adopting a vegetable diet, and an alterative medicine, they soon disappeared.

---

* From his "*New Medical Discoveries*," just published.

"I once saw a young man, who had been treated for a white swelling in the elbow-joint, and had taken a considerable quantity of calomel. A plaister of the butter-cup was applied to the swelling, which in a short time brought on a most active inflammation. I was called in to see the patient, after ulceration to a considerable extent had taken place. I found the bones of the arm, from the shoulder joint to the wrist, in a carious state; the face and eyes were also much affected, and the patient was diseasad beyond hope of cure.

"In the case of a young lady, afflicted with an indurated gland or swelling on the side of her neck, a small slice of the root of ranunculus was applied to the humour at night. It drew a blister, which broke before morning; the water discharged from it, corroded the skin as far as it extended; her face and nose became much inflamed and swelled, and the roof of her mouth was ulcerated. I prescribed a vegetable diet, alterative medicines, and the vapour-bath, which soon subdued its effects. I could cite innumerable other instances of its mischievous effects in the course of my experience.

"I am no stranger to the effects of *poppies* on horses. A friend of mine, who sometimes feeds his on green vetches, with almost an equal quantity of poppies intermixed with them, directed my attention to the circumstance, that all the animals but one that partook of the latter were hide-bound, and had their hair standing on an end; the one excepted was in good condition, and ranks among the best in the kingdom. In consequence of inattention to the food of these animals, they have frequently to be drenched with drugs, and have their legs blistered, in order to draw off the poisonous humours from their bodies. I have travelled over a large portion of the globe, but never witnessed a parrallel to what I have seen in England: the horses, like the people, with diseased blood-vessels, and the veins of the legs of the former varicose. It is common to see cart-loads of green clover and poppies, and green corn and poppies, brought into town to feed the milch cows. It is true indeed, that the cows are not so much affected thereby as the horses, for the poison passes off by the milk-vessels, and the milk is regularly served out to the inhabitants of this great metropolis, and particularly to the children. A portion of the green fodder may indeed be free from the above plants, and if all fodder were so, it would be a fortunate thing for the public; and especially for the cooks, who would rejoice in getting milk free from the poison; as it would prevent many a mishap to their puddings, pies, &c. that may contain a portion of the milk procured from cattle fed on poppies.

"When I first observed the complaint in horses, their stomachs were diseased from eating the poisonous plants above described. I found the veterinary surgeon had been giving them sixty grains of calomel; and that the animals, whilst drinking at the brook, were allowed by the ostler to wade in the water, when their legs immediately swelled, and become covered with varicose veins. I have indeed discovered that plants alone will produce the same disorder, and independent of the use of mercury, although not to the same extent.

"I might mention upwards of a hundred other plants that are more or less injurious in their effects upon the animal economy; but these may be considered but as secondary in comparison with the above; and the landlord and farmer in destroying them, would find little difficulty in removing the others. Every reflecting mind must be aware, that no animal can eat the above poisonous plants to any extent without becoming diseased; and also that no human being can use the milk, butter, cheese, or meat, the produce of such animals, without contracting those disorders of body and mind, that it is the very nature of those plants to produce.

"I assert, and will maintain, that half the surface of the pasture lands, to a great extent round London, are covered with these plants; and that it is not the wet seasons which are the causes of the diseases and mortality among men, horses, cattle, and sheep, but the poison that is imbibed from the plants, either directly or indirectly. Wet seasons will, it is true, render poisonous plants more abundant and active; as may be proved from the circumstance, that on the contrary, the prevalence of warm weather causes their destructive properties to evaporate, and parches them up to a certain extent. For instance, when grass is cut in warm weather, the roots of the plants suffer from the heat, and do not spring up in such abundance in the autumn; and the hay that is well cured, unless it be heated in the stack, the farmer says, will disease the horses. This view of the subject is at variance with a good system of agriculture, for if there were nothing produced but good clover, and wholesome grasses, the more their juices were preserved, the better it would be for the stock fed upon them. When the grass is cut in wet seasons the roots do not suffer, they are well established; they spring up in great abundance in the fall, and continue in full vigour during the greater part of the winter. This was the case to a fearful extent last autumn. I never saw the poisonous plants so abundant and active in their powers before, and therefore their effects were particularly visible upon the live stock.

"Were the fields properly fallowed, and cleared of every description of poisonous plants, and sown with clover and the best grasses, then wet seasons would not disease the stock. This suggestion, if acted upon, would be attended with the most beneficial effects to the country. It may indeed be asked, whether those poisonous plants did not exist in former periods? Yes, I would reply, they have existed, *but not to the same extent!* Their ill effects were, as a duty, pointed out by the faculty, and particularly during the reign of Queen Anne; and that is, no doubt, the reason why none of the plants are to be met with in the downs, common-lands, and old deer-parks. Another instance in proof of the fact is, that formerly England and Ireland were agricultural countries; the great bulk of the inhabitants then lived upon the produce of the soil; their farms were small, and the lands were frequently ploughed, which, in a great measure, destroyed the poisonous plants. The great political question which was agitated between the Earl of Bute, and the Earl of Chatham, whether the former's measures in favour of commerce, or those of the latter in favour of agriculture, should be adopted, and which terminated agreeably to the views of the former, occasioned the inhabitants to abandon the soil, and congregate in large cities, towns, and villages. The consequences of such a policy were soon evident. The landowners and cultivators converted small into large farms; and instead of raising large quantities of grain, the land was made to produce grass; they not being aware at the time, that they were opening a field for the production of those poisonous plants, which were not so abundant in any other country upon the face of the earth! Subsequently, indeed, when the French revolutionary war broke out, a number of the grass fields were ploughed and sown, in order to obtain the large supply of grain which was required for the army and navy. This circumstance had the good result of destroying the weeds and poisonous plants; but as soon as peace was again enjoyed, a portion of the fields were again laid down into pasture grounds, with a quantity of poisonous seeds mixed with the grass seeds, and generally sown promiscuously. What grass is now left in the fields in the summer months, is choked and destroyed by the great increase of weeds and poisonous plants; and the longer the fields are allowed to remain in their present state, the more the evil will increase."

X.—*On Improvements in Effacing in Lithography* *.

The power of *effacing* any part of a design, and of *retouching* it again at pleasure, was one of the most desirable ameliorations in lithography. Two different and opposite means have now conduced to this happy result. The first, and which would naturally present itself to any person conversant with chemistry, consists in the employment of an *alkali*, to dissolve the fatty and viscous materials, by means of which the printing ink attached itself. It is in this manner that M. M. *Chevalier* and *Langlume* have resolved the problem, and their success is a new proof of the advantages which result from combining theory with practice. These gentlemen have already published their discovery, in a complete work of their composition; and which has not a little contributed to the progress of lithography.

---

* From *Bulletin de la Soc. d'Encourag.*, Nov. 1828.

The other process was contrived, by uniting two different methods; and was also the result of practical observation: namely, the employment which is daily made of an acid, more or less strong, to remove the spots which form themselves upon the margins of the lithographic stones, in printing from them, gave rise to the supposition, that a *vegetable acid,* which should exert but little action upon the stone, would yet suffice for completely effacing all the fatty parts, and thus permit us to make all manner of changes on the places thus perfectly cleansed. This conjecture has been confirmed by the fullest success. The following is the manner of executing this mode of effacing:

We commence then, by first removing with *essence of turpentine,* the ink, or the traces of the crayon, from the part where we would change the subject; we then apply, with a hair-pencil, a little *vinegar.* The acid is then removed with a sponge moistened with water; and when the place has become dry, it may be re-touched with the same facility as upon a new stone. This process, by means of the vinegar, is a rather quicker and more convenient one for the removal of *writing* from the stone. But in other cases, the employment of *alkali* is more advantageous; it is, in fact, only experience which can determine in which case either of the methods should be used; and indeed there are some cases in which either method may be indifferently employed.

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since May 21, 1829.

To Maxwell Dick, of the town of Irvine, in the county of Air, North Britain, bookseller and publisher; for an improved rail-road, and method of propelling carriages thereon by machinery, for the purpose of conveying passengers, letters, intelligence, packets, and other goods, with great velocity. Dated May 21, 1829.—To be specified in six months.

To Thomas Robinson Williams, of Norfolk-street, Strand, in the county of Middlesex, esq.; for improvements in the making or manufacturing of felt, or a substance of the nature thereof, applicable to the covering of the bottoms of vessels, and other purposes. Dated May 23, 1829.—In six months.

To Thomas Arnold, of Hoxton, in the county of Middlesex, tin-plate worker; for a new or improved machine or gauge, for the purpose of denoting the quality of fluids, or spirituous liquors; and for measuring or denoting the quantity of fluids or spirituous liquors withdrawn from the vessels or receptacles in which the same are contained; and which machine or gauge may be so constructed, as to effect either of the above objects, without the other, if required. Dated May 26, 1829.—In six months.

To William Poole, in the parish of St. Michael on the Mount, in the city of Lincoln, smith; for certain improvements in machinery for propelling vessels, and giving motion to mills, and other machinery. Dated May 26, 1829.—In two months.

To Charles Turner Sturtivant, of Hackney, in the county of Middlesex, soap-boiler; for certain improvements in the process of manufacturing soap. Dated May 26, 1829.—In six months.

To Joseph Cliseld Daniel, of Lamplay-stoke, in the parish of Bradford, in the county of Wilts, clothier; for certain improvements in machinery, applicable to dressing woollen cloth. Dated May 26, 1829.—In six months.

To Ross Winans, of Vernon, in the county of Sussex, and State of New Jersey, in the United States of North America, at this time resident in London; for certain improvements in diminishing friction in wheel-carriages, to be used on rail and other roads; and which improvements are also applicable to other purposes. Dated May 28, 1829.—In six months.

To William Mann, of Effra-road, Brixton, in the parish of Lambeth, and county of Surrey, gentleman; for his discovery, that by the application of compressed air, power and motion can be communicated to fixed machinery, and to carriages and other locomotive machines; and also to ships, vessels, and other floating bodies. Dated June 1, 1829.—In six months.

To Andrew Gottlieb, of Jubilee-place, Mile-end-road, in the county of Middlesex, locksmith; for certain improvements on, or additions to, locks and keys. Dated June 1, 1829.—In six months.

To John Smith, of Bradford, in the county of York, corn-miller, being one of the people called quakers; for certain improvements in machinery for dressing flour. Dated June 4, 1829. In two months.

To Charles Brook, of Meltham Mills, near Huddersfield, in the county of York, cotton spinner; for certain improvements in machinery for spinning cotton, and other fibrous substances. Dated June 4, 1829.—In six months.

To Robert Porter, of Carlisle, in the county of Cumberland, iron manufacturer; for a certain improvement or improvements in iron heels and tips for boots and shoes. Dated June 13, 1829.—In two months.

To Francis Day, of the Poultry, in the city of London, optician; and August Münch, mechanic, of the same place; who in consequence of a communication made to them by a certain foreigner residing abroad, and inventions by themselves, are in possession of certain improvements on musical instruments. Dated June 16, 1829.—In six months.

To Charles Wheatstone, late of the Strand, but now residing at No. 20, Conduit-street, in the county of Middlesex, musical instrument maker; for a certain improvement or improvements in the construction of wind musical instruments. Dated June 19, 1829.—In six months.

To Moses Poole, of the Patent Office, Lincoln's Inn, gentleman; who in consequence of a communication made to him by a certain foreigner, residing abroad, is in possession of certain improved machinery for kneading dough. Dated June 19, 1829.—In six months.

GILL'S

TECHNOLOGICAL & MICROSCOPIC REPOSITORY.

I.—*On the Microscope.* *By* THOMAS CARPENTER, *Esq.*

WITH FIGURES.

DEAR SIR, *London, July* 14, 1829.

A FEW days back, I was attentively examining one of the scenes exhibited at our friend, Mr. Philip Carpenter's, of Regent Street, by his grand solar microscope, when I observed one of the larva of the *hydrophilus* dart at, and seize a large larva of a species of *dyticus.* As this latter insect is furnished with fangs, capable of offence and defence, I was much surprized at its not making any resistance. At first I imagined that the extreme heat from the collected rays of the sun had rendered it languid; but on examining it, after the exhibition had closed, I found that was not the case; the fact was, that the insect at the time it was attacked, was preparing to cast its skin, as all the new organs under it were arrived at maturity. I preserved its head, and have enclosed it between two slips of glass, which I send for your inspection. You will observe, that every new part corresponds with the old ones, they lying, as it were, within a case, the outer skin being partly drawn off, similar to a glove from the hand.

I was favoured by the exhibitor, Mr. New, with two or three cast skins, which had been thrown off by the larvæ of the *hydrophilus.* The heads from these skins are also placed between the same glass; and by which you will observe the distinguishing characters, between the heads and fangs of the larvæ of the *hydrophilus,* and those of the *dyticus.*

During the before-mentioned solar exhibition, one of the party observed to a friend, that the cheese mites, some of which he had just seen magnified to the length of twelve inches, eventually changed into those grubs found so frequently in cheese, and which are known by the name of jumpers or hoppers. Now this observation of his, was completely erroneous; for the mite is a perfect insect, and undergoes no farther change. With respect to the hoppers, they are the larvæ of certain black flies, of the genus *musca*, which deposit their eggs in the crevices or holes of cheese. The maggot, when excluded from the egg, is surprisingly strong and vigorous, and leaps to a considerable distance when disturbed. To do this, it erects itself on its tail, and bending its head round into a circle, fixes its two black claws, at the end of the tail, into two cavities, formed for their reception at the back of its head; it then exerts its muscular powers, and in suddenly extending its body, throws itself (considering its size) to a vast distance. One of these insects, not a quarter of an inch long, has been known to leap thus out of a box, which was six inches deep, or twenty-four times its own length!

The rottenness of cheese is, in a great measure, occasioned by these little maggots; for they crumble the substance of it into small particles; and the smallest tainted or decayed spot immediately spreads when any of them lodge upon it. When they are about to change into chrysalids they desert the cheese, and in three or four days afterwards become stiff and lifeless. The fly bursts through an opening in the skin just at the head, which there divides into two parts. At its first appearance its wings are not fully formed, but it is able to run about with great activity; the wings however expand by degrees, and in the course of a quarter of an hour they are perfected. These flies are exceedingly prolific, for in the ovary of a single female, no fewer than two hundred and fifty-six eggs were found.

In order to illustrate the foregoing remarks, I selected from a piece of cheese, several of the maggots in their very young state, and placed them within a wine glass, together with some cheese, and covered the top over with a piece of muslin. After feeding their accustomed time in the larva state, they underwent their change into the pupæ, and finally came forth perfect flies. I send for your inspection two pieces of card, on which are placed a few of these larvæ; and also some of the crysalids, together with the perfect flies. One of the crysalis cases I have opened, in order to shew the grub within it; the other cases are empty, but the flies which came out of them are attached to the card. The wings of these flies, if placed on a black ground, and viewed as opaque objects, exhibit the most splendid colours under the microscope.

On my returning from Mr. Philip Carpenter's exhibition, I called in at the shop of Mr. Cary, optician, in the Strand, where I was informed by Mr. Gould, that some persons being of opinion that the motion of the molecules, discovered and described by Mr. R. Brown, of the British Museum, was either occasioned by the action of the breath of the party examining them under the microscope, or by the watery particles evaporating. In order to ascertain the fact, he had placed some exceedingly minute particles of gumboge in a fluid, which he secured hermetically, betweeen a slice of talc, and a glass slip, so that they could neither be affected by the breath nor the atmosphere. At the time I observed these particles, they were in a constant motion of attraction and repulsion; and Mr. Gould informed me, they had then been between the glass and talc for seven days previous to my observing them. The lens under which I viewed them, was the thirtieth of an inch focus.

During the last week, I was staying with a friend at Tottenham, near whose house was a pond, well stored with aquatic insects in their various states; and from which I selected a few larvæ of the *dyticus*, and also three tad-poles, in their progressive state towards the perfect frogs. Wishing to shew my friend the circulation of the blood, which so beautifully meanders through the numerous vessels in the tails of the tad-poles, I placed them in a small bottle, together with the larvæ of the *dyticus*, and took them immediately to his house; and although the distance was not more than a quarter of a mile, which of course occupied me but a very short time in walking; yet in that short space, the larvæ of the *dyticus* had contrived to kill the tad-poles, by plunging their formidable fangs into them, for the purpose of extracting their juices! The bodies of the tad-poles were so much lacerated, as to lay open to view the whole of their intestines; which, under the microscope, exhibited a most astonishing sight; presenting in appearance the interior of the body of a large quadruped. I cannot do justice to what I witnessed by any description of mine, at all equal to what has been done already by Swammerdam and Lewenhoek, to whose works I beg to refer you, both of whom have entered very minutely into the anatomical structure of these animals; but shall content myself with making a few observations on what they appear to have overlooked; viz. the jaws and teeth.

In the fourth volume of your *Repository*, page 134, you have made some remarks on a dissected jaw of the tadpole, which I shewed you under my microscope; this jaw was extracted from a tad-pole in its first stage, and previous to the legs making their appearance. Your observation respecting other rows of teeth, besides those on the edges of the jaws, are fully borne out, by some experiments I have made on the three tad-poles above-mentioned, and which I now send for your examination, preserved in spirits of wine. One of these is in its first stage, just shewing the rudiments of the legs; you will find, that on looking at the mouth of this, there appears to be but one row of teeth. There are, however, other rows within the mouth, but not fully developed, similar to the one described by you. The next is in a more advanced stage, with the two fore-legs perfect, and exhibiting other rows of teeth, not yet arrived at maturity. These jaws I have taken out, and placed between two slips of glass, for your more accurate inspection. The third tad-pole is in its last progressive stage towards the perfect frog, having its four legs, in addition to its tail; and which last appendage it would very soon have thrown off. You will now perceive the various rows of teeth are all completely formed, and lie embedded in the jaw of the animal, somewhat after the manner of the teeth in the jaws of the shark. This last tad-pole, if taken out of the spirits, and placed under the microscope, will afford you an interesting spectacle, in the view you will have of its intestines, and also of its minute and delicate rows of dark coloured teeth.

In the same pond from whence I took these tad-poles, I found two larvæ of a species of *dyticus*, very different in appearance to those before-mentioned; the eyes of these are very beautiful, and very much resemble those in some spiders; the apparatus about the head is very powerful, and capable of carrying on the work of destruction, to a great extent, among other aquatic animals. I also met with a small species of libellula *(l. virgo)* in the bank of this pond, in a dying state, from some injury it had received. On examining it, I perceived several minute *acari* attached to the under part of its thorax; these probably might have occasioned its death, as I could not discover any marks of violence on any part, except from the attacks of these parasites. At the time I took up the libellula, I observed running among the grass, near the brink of the pond, a small beetle *(bembidium flavipes)* possessing fine markings and characters, which I send you with the above insects; together with a very rare species of the genus *pselaphus*, which I met with near the same spot. This insect is very minute, but exceedingly curious when examined under the microscope. It appears to possess four antennæ; the two smaller ones resemble very much the antennæ of certain species of curculio. Yet I am informed, by an entomological friend, more conversant in this branch of natural history than myself, that these organs are not antennæ, but the palpi of the insect. However, it is a very singular character, and such as I have never seen in any other genus.

While sitting at a window in my friend's house, I observed on the glass, numerous flies of the genus *empis*; but of a smaller and different species to those already described by me, in your *Technological Repository*, vol. IV. page 213. And on the same window were many other flies of the genus *dolichopus*. The empis were busily employed in destroying those other flies, by seizing them, and perforating their thorax with powerful instruments, which they put forth from their proboscis. Now to me, this appeared a most barbarous act towards their companions, who it seems had done them no injury; and it was really revolting to one's feelings to witness it. But no doubt it was a necessary act, instinctively given to the *empis* to perform, in order to make thinnings among the *dolichopus*, and thus to keep the balance even.

I have dissected the proboscis of one of this species of *empis*, and send it for your examination, placed between slips of glass; as also some plates from the cornea of their compound eyes, which are studded with exquisitely fine and minute lenses.

With these you will also receive a few of the *dolichopus*, which, if placed under your microscope, and viewed as opaque objects, you will find present a very splendid appearance. There are also the singular organs attached to the end of their abdomen, which will afford you much interest in their minute examination, as curious microscopic objects.

In your *Technological Repository*, vol. III. page 227, I entered into a short history of the habits of a species of the sand-wasp; in which I stated, that these insects generally selected such caterpillars as were about to pass into the pupa state, in preference to caterpillars that had not done feeding, in order to supply a sufficiency of proper and wholesome food for their offspring, when excluded from the eggs. Those observations of mine, I have the pleasure of stating, are now fully corroborated, by a circumstance which occurred, at the time I was observing the murderous attacks made on the *dolichopus* by the *empis*. A caterpillar having fed its accustomed time, was about to pass into the pupa state, for which purpose it had crawled to the window; and was about to enter the room for the purpose of retreating to some recess, where it might quietly undergo its change; when a species of sand-wasp alighted on the window-frame, and instantly seizing the caterpillar, began to insert its sting within it, in order to weaken its resistance in being conveyed to the nest of the wasp. I rescued the caterpillar from its attacks, by capturing the wasp; which having killed in my usual quick method, by putting it into boiling water. I set it, and placed it in my cabinet. This wasp I send you for your inspection; you will perceive its powerful jaws, and the apparatus about its mouth; as also its sting, which I have drawn out from its abdomen, and separated from the sheath.

The eyes of the *ephemera vulgata*, mentioned by me in your present volume, page 6, being compound ones, consisting of many thousands, and very prominent; I was induced to attempt dissecting one of them, and having succeeded, I herewith send the same, between a talc slider, for your inspection. You will observe the numerous lenses of which it is composed; and also, that in each lens, the image of any object may be seen. At this moment I have it under my microscope, with the image of the window-frame, and the tassel of the sun-blind vibrating to and fro, reflected in each lens.

In the same slider you will also find the dissected proboscis of a species of *rhyngia*, and the fine wings of the same insect; the very delicate wing-cases of a very small species of *cicada*; and one of the late celebrated Custance's very best cuttings from the root of the lime-tree: this last object is well preserved throughout the whole series of its air and sap-vessels.

As you continue increasing your present collection of microscopic objects, I now send a few, which are not usually met with at the opticians, for your examination: viz. a scale from the whiting, which you will find a very delicate object; a few egg-shells from the *cimex lectualrius*; the granulated characters on these are very curious. Also a few portions of the small fins of the lobster, to which are attached numerous delicate hairs, of a feathery appearance. A piece of skin, from a species of *squalus*, from which is prepared the shagreen. And also other pieces of skin from the lump-sucker fish, and a Chinese flying-fish; and also a piece of the outer skin from our common garden lizard. These may be viewed either as transparent or opaque objects. I also send two portions of the under skin from the same lizard, the scales of which are very fine; likewise part of a scale taken from a *boa-constrictor*, which serpent measured when alive, upwards of fifteen feet in length. With these I also send three minute feathers, taken from the breasts of three species of humming-birds, viz. the ruby, the topaz, and the emerald. These three objects you will find more rich in splendid colours than the precious stones themselves, after which the birds are named.

I remain, dear sir,
Your obliged friend,
THOS. CARPENTER.

To THOMAS GILL, *Esq.*

Remarks and references to the figures, by the EDITOR.

In plate II. fig. 1 represents the several rows of teeth in the jaw of a tad-pole, mentioned by Mr. Carpenter in the above letter.

Fig 2 is a side view, and fig. 3 a top view of the head of the larva of a *dyticus*, brought by Mr. Carpenter from the pond at Tottenham; in the former of which figures, or the side view, will be seen six of its *twelve eyes*; viz. two large and prominent ones, which are placed so as to look upwards and forwards; and four other smaller ones, calculated to see behind and underneath. In fig. 3, four of these eyes are seen on each side of the head. These two figures also exhibit its powerful apparatus for devouring other aquatic animals.

Fig. 4 is the head, antennæ, and *palpi*, or feelers of the *pselaphus*, the *palpi* being affixed to the bases of the antennæ. The granular and prominent eyes of the insect are also distinctly shewn.

Fig. 5 is the head of the sand-wasp, mentioned by Mr. Carpenter; in which its powerful jaws, antennæ, and other apparatus about its mouth are distinctly shewn; as also its two compound eyes, and its three *stemmata*, or single eyes, at the back of the head.

Fig. 6 is part of one of the *elytra*, or wing-cases, of a small species of *cicada*, mentioned by Mr. T. Carpenter; in which the ribs, accompanied by singular round spots, are shown.

Fig. 7 is part of the shell of an egg, of the *cimex lectularius;* on which granulations, as described by Mr. Carpenter, are shewn dispersed, in a curious and reticulated manner.

In fig. 8, portions of the delicate feathery hairs around the small fins of a lobster, described by Mr. Carpenter, are shown.

Fig. 9 represents a piece of the skin from a Chinese flying-fish; in which two of the serrated projecting scales upon it are shown.

We can confirm the appearances of the objects in the lenses of the compound eyes of the *ephemera vulgata*, as described by Mr. Carpenter, from our own observations; and have also to add, that our own larva having been unfortunately killed by the bite of a polype, we have found that the blood-vessels are filled with *a crimson or pink-coloured fluid*, which is not commonly the case with those of insects; and that, consequently, the courses of the arteries and veins are very distinctly seen in the prepared objects.

Fig. 10 exhibits highly magnified views of parts of one of the beautiful, and most splendid minute feathers of a humming-bird, mentioned in Mr. T. Carpenter's letter. Each part is terminated by a delicate tufted hair proceeding from the middle of it.

(To be continued.)

XII.—*On an Improved Machine for Boot and Shoe-makers, Sadlers, Harness-makers, &c. By Messrs.* JAMES DOWIE, *and* ALEXANDER BLACK*.

WITH FIGURES.

4, Register Street, St. Andrews' Square,
Edinburgh, Jan. 8th., 1828.

SIR,

WE have the honour to enclose for the consideration of the Society of Arts, a notice regarding an apparatus for the use of boot and shoe-makers; and also *four* certificates from masters in the trade, who have had those in use which were formerly invented, and *three* of whom now use the kind which is herewith sent; *eight* from other masters, who have had an opportunity of judging of its usefulness, *two* of them having used them; and *twelve* from workmen, who have had like opportunity, some of them having wrought, and are still working with them.

We are, sir,
&c. &c. &c.
JAMES DOWIE,
Boot-maker.
ALEX. BLACK,
Surveyor.

A. AIKIN, *Esq.*
Secretary, &c. &c.

---

* From Vol. XLVI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted a silver Vulcan medal to each of these candidates.

The posture in which boot and shoe-makers usually work, has long been known to be injurious to their health, and has led to the invention of several plans for executing their work in a more favourable position; none of these however have been generally adopted, owing to their not fully answering the intended purpose; and also from circumstances connected with the trade itself.

I shall as briefly as possible state a few facts illustrative of what I mention: first, it is known to medical men, that the workmen are in general liable to indigestion, gravel, piles, and other analogous diseases; arising, in a great degree, from the constrained posture in which they work.

The mode the workman adopts when sitting is as follows:—The *boot-closer* executes his branch by the assistance of an instrument styled a pair of clamps; which is merely two pieces of flexible wood, such as ash, about two feet six inches long, by three or four inches broad, fixed on a block at their under ends, in the form of a triangle, and sometimes in that of an ellipse. The work is put in between the jaws at the top, and is held in the clamps by the pressure of the knees of the workman. Another part of this branch is done on a block of wood, laid on the left knee, and steadied there by means of a strap, passing under the sole of the foot, and over the block on which the work is placed.

The workmen, when making either shoes, or the feet of boots, generally use the same sort of strap; but sometimes hold the shoe between the left knee and the chest, causing those parts to answer the purpose of a vice; and also often hold the work between the knees, the thighs serving as a support, while hammering and finishing it. The hard leather is prepared by hammering it on a stone or smooth iron block, laid on the thighs of the workman.

A want has always been felt, of some apparatus, by which the boot or shoe might be kept firm in any required position, without constraining the workman to adopt postures so inimical to his health, as he is obliged to assume in the ordinary mode of working.

Among the first inventions for this purpose (that we know of) was one by Mr. Holden, of Fettleworth. His method was, to keep the boot or shoe on a cushion, in order to sew it; but, from the description, it does not appear capable of permitting him to perform other operations, such as hammering and finishing at least, with ease to himself, or safety to the machine; and is incomplete, for want of a proper closing apparatus.

The next is that of a Mr. Parker, and is described by Mr. Smith, in his "*Compendium of Practical Inventions*," as "consisting of a bench, standing on four legs, the top of it being about four feet from the ground; a circular (or rather annular) cushion, in diameter at least equal to the length of the shoe, is placed on the bench. Through the centre of the cushion, and through the bench, is a hole to admit a strap, which being brought double through the hole, forms on the top of the cushion a loop, to admit the shoe containing the last; when, therefore, the lower ends of the strap are fastened to a board placed on the floor, like the treadle of a foot-lathe; the workman, by treading upon this board, holds the shoe sufficiently tight upon the cushion to proceed with his work; and by taking off the pressure of his foot, the shoe can be turned or taken off. The cost is estimated at two guineas." This one, however, requires the workman always to stand, in order to press down the treadle with his foot, and is therefore necessarily fatiguing. In this, as well as the other, there is no contrivance for closing.

There is another, by a Mr. Johnson, somewhat similar to the last one described. They differ in this, however, that the cushion of the latter is there substituted by an oblong block of wood, rising on each side, like the two thighs of the workman; a strap passes through it, as in the other, but instead of being attached to a foot-board, it is fixed to a spring, which allows the workman either to stand free, or to sit on a high seat. The disadvantage attending it is, that the strength of the spring must be so great, that the workman cannot adjust his work quickly. There seems to have been a kind of clamps attached to it, but which partake of the same inconvenience.

A Mr. Stass invented a form of clamps, with a joint like that of pliers, and a strap attached to each end of the lower parts, and affixed to a treadle. All which, however, from the workman being obliged to stand, in order to press down this treadle, rendered it as difficult to use, as when sitting in his former condition; the only advantage being, that of having his body in a more upright posture.

The plan now offered to the Society of Arts, is intended to obviate these difficulties.

I have been assisted in bringing the apparatus to its present convenient form by Mr. Alexander Black, surveyor. We have, in conjunction, endeavoured to arrange it so, as to adapt it to all the purposes of the workmen; and to avoid the defects of the usual methods, and also of those which appeared to us to exist in the other plans mentioned above.

I have had several of the machines in use by my men, since the end of the year 1824; and feel warranted by experience, in saying, that they answer perfectly, both in affording facility and dispatch; and also in improving the situation of the workmen in regard to their health; while no trouble has been found in their adoption by men who had been accustomed to work in the old way.

The machine which accompanies this, may be considered as of a proper average size, it being of the same dimensions as those at present in use here; it may vary in its height, according to that of the workman.

The frame consists of four legs, a bottom, and a top; with rails across, for the reception of the pivots of the wheel and axle. There are also a pair of clamps, a block for flat seams, and a circular block, stuffed and covered with leather; all of which are occasionally placed on the top of the frame as they may be required.

There is a weight of about seventeen pounds, attached by a strap of leather to the rim of the wheel. The pedal for raising the weight, and releasing the work, is attached to a smaller wheel on the axle by another strap, and slides on brass friction plates, placed on one of the legs. The circular block, and the small cushion, serve as a bed for the shoe to rest on during every part of the operation, except in closing; and they are kept firm by another strap, from another small wheel upon the axle, passing up from it, and over them, through a hole in the top of the frame.

The form of the clamps is, I believe, new, and is very convenient, as the work to be held in them is adjusted by the operation of the pedal, and is connected to the power of the axle, by means of a fixed strap and hook, to a swivel on the former strap. The block for flat seams is also held by the same means as the shoe.

It may be here noticed, that the closing apparatus is also well adapted to the use of saddlers and harness-makers.

One cause of the plans formerly proposed not being adopted, arose, as I have stated, from circumstances connected with the trade itself; and will therefore apply to this invention as well as to them. This cause, I humbly think, may be obviated with advantage, both to masters and workmen. The men at present work chiefly in their own houses, which are thus rendered inconvenient to their families, as they seldom or never have a separate room to work in; and the masters have not the advantage of the immediate superintendence of the workmen, they being all scattered in different parts of the town.

Now this could be obviated, in my opinion, with a little expense, and a great deal of comfort be thus secured to the workmen, as well as convenience to the masters, if the latter were to provide workshops for their men, furnished with these machines, according to the number of hands they employ. In such an arrangement, the master would have it in his power to inspect his work at once, and see his materials properly manufactured, according to his own directions, and without having the necessity to go to all his workmen's houses. There would also be a stimulus to the workmen to improve in their work, as well as many other advantages. One of these, in my opinion, would be, to lead the men to great habits of sobriety and industry; and I am borne out in my opinion, by conversations which I have frequently had, both with masters and workmen.

When it is considered that the trade of shoe-making is practised in almost every country, and that the workmen form a considerable part of every community, it is hoped that any plan conducing to the improvement of the habits and health of such a numerous class, will not be deemed unworthy the attention of a Society, which does so much for the promotion of the Useful Arts, and for the welfare of the working classes.

James Dowie.

References to the figures of Mr. Dowie's shoe-making machine; one-eighth of the real size.

In plate II, figs. 11 and 12, are front and side views. It consists of four wooden bars, *a a a a*, framed together at the top by other bars *b*, and into a block *c*, at the bottom; three sides are closed with thin boards *d d d*; and the fourth by a door *e e*, which hides the inside, and makes it appear like a post. In fig. 12, the side board is removed; *f f*, are two holes, through which studs *g*, fig. 11, fixed in the board, pass; fig. 13 is a pin, which is passed through their eyes, to keep the board in its place, it being also stopped in the bottom block; *h h*, fig. 11, the two hinges of the door *e*, it being removed; *i*, a block fixed in the top, having a round hole through the middle of it, and a circular recess *j j*, shewn by dotted lines; on this lies the cushion-block *k*, also perforated, and having a circular projection, which goes into the recess *j*, and keeps it central: this cushion is the substitute for the workman's lap; on it the work is held by the strap *l l*, which is connected to a strap *m*, by two swivel links *n n*; these allow the work to be turned about any way without twisting the strap *n*, which is fixed to a small barrel on the axle *o*; *p p*, a larger strap-wheel on the same axis; *q*, the strap, which is fixed at *r*, and supports the weight *s*. The wheel *p*, is three times as large as the barrel *o*, and therefore the weight *s*, holds the work three times as tightly as it could do by its own weight only; *t*, another small barrel, also on the same axis, having a strap *u u* fixed to it; this strap is buckled to a sliding pedal *v v*; *w w*, the slit in which it moves up and down: *x*, a flat part of the pedal, which rubs against the brass plates *y y*; *z*, a similar piece rubbing against inside plates; a gap is also made in the board *g* for the pedal to move in. By treading on this pedal, the weight *s* is raised, and the work released; and on removing the foot from off the pedal, the work is again held tight.

Fig. 14 the closing vice or clamp. Fig. 15 a top view of it opened: *a a* the two hinges; *b b* the jaws; in the centre hole there is a screw *c*, from which hangs a strap *d*, having a hook at bottom. Fig. 16 a side view of the strap; when this is used, the cushion-block *k* is removed, and the strap *l* allowed to hang down from the swivel *n*; the closer or clamp is then put on it, having a projection *j* to enter the recess, and the strap *d* is hooked to the swivel; the weight *s* then keeps its jaws tightly closed, yet they may either be pulled open by the hands, or released by means of the pedal *v*. The dotted lines, fig. 14, shew the action of opening the clamp; when its two corners *e e* rest on the block *i*, the weight *s*, acting on the strap *d*, pulls the middle part down to close the jaws. Figs. 17 and 18, are side and end views of a block, to be held down by the strap *l* on the top *i*. Figs. 19 and 20, are side and end views of a soft pad or cushion. Fig. 21 a top view of the cushion-block *k*.

Certificates.

14, South-college-street, Edinburgh,
Dec. 11, 1827.

We hereby certify, that the machine for the use of boot and shoe-makers, made after the model of Mr. Parker's, was in use by us, but we did not find it answer so well as that made by Messrs. Dowie and Black, and which is used by us at present; and we think it would be a very valuable acquisition to the trade, if its use was become general.

ANDREW DEWAR,
ALEX. C. DEWAR,
JOHN DEWAR.

Edinburgh, Jan. 5, 1828.

I have minutely examined the machine, recently invented by Messrs. James Dowie and Alexander Black, of this city. The object of this invention is, to combine an improved attitude or position of the shoe-maker's body, when employed at work, with every requisite perfection in the quality of the workmanship produced; and my decided opinion is, that by means of the present machine, these desirable ends are very successfully accomplished. In the improved state to which the invention is now brought, it is applicable to all the different branches of boot and shoe-making, in all the varieties and particular parts of the same; while the position of the body is manifestly improved. My opinion is, that in all the departments of the trade, the use of this machine equals, and in most of them excels, the usual modes of operation practised by the craft.

JAMES DOW,
Boot and shoe-maker.

4, William-street, Edinburgh,
GENTLEMEN, *Jan. 7, 1828.*

I do hereby certify, that I have wrought at my trade of boot and shoe-making, for the space of twelve months, on the machine invented by Messrs. Dowie and Black, and find it in every way exceedingly convenient for the completion of every branch of the trade; and I think that it would be advantageous to the health of the craftsmen, if it was in general use.

JOHN TOLMIE.

GENTLEMEN, *Edinburgh, Dec. 27, 1827.*

I do hereby certify, that the machine invented by Messrs. Alexander Black, surveyor, and James Dowie, boot-maker, is completely calculated to perform all the different parts of boot and shoe making, having wrought at one of them for upwards of two years.

JOHN ANDERSON.

SIR, *Edinburgh, Jan. 5, 1828.*

I have examined your machine for improving the mode in which shoe-makers perform their work. The present method of working is extremely uncomfortable, from the stooping posture in which they are obliged to sit; and at the same time, very injurious to health, from the pressure of their work upon the breast. In your machine all these disadvantages are remedied, as the workman may either sit or stand upright, and perform all the parts of boot or shoe-making with the greatest facility.

Some years ago I attempted to work with a machine intended for the same purpose as your's, but from defects in its construction, it did not answer to my wish, and therefore I laid it aside; but I find all its deficiencies remedied in your machine; and I have no doubt, when it comes into general use, it will be found of the greatest utility to the trade.

I am, sir, &c. &c. &c.

To Mr. JAMES DOWIE, Boot-maker. J. WALLACE.

Remarks by the EDITOR.

We highly approve of this ingenious application of the differing diameters of the wheel and barrel, to make the weight of seventeen pounds, do the work of one of upwards of fifty! We think, however, that it would be an advantage, to connect a strap with that which passes around the larger wheel, and to which the weight is hung, and make it pass over a barrel mounted in the side of the frame, down to the pedal; as by this means, the workman would only have to exert a power of *seventeen pounds* to raise the weight itself only, and disengage the work, instead of employing one of *upwards of fifty*, as is required by the present arrangement.

XIII.—*On the Duke of Bridgewater's Canals* *.

THOSE magnificent plans, which have rendered the name of the *Duke of Bridgewater* so celebrated in the history of canal-navigation, commenced in the year 1758 and 1759, when acts were passed, enabling him, first, to carry a canal from Worsley to Salford, and also to Hollin-ferry, on the Irwell; and secondly, to deviate from that course, and carry his canal from Worsley across the river Irwell to Manchester, through the township of Stretford. Possessing an extensive property at and near Worsley; rich in coals, which could not, by land carriage, be conveyed to Manchester so advantageously, as those from the pits on the other side of the town; the Duke was naturally led to consider of a better mode of conveyance. The formerly projected, but unexecuted scheme, of making navigable Worsley brook to the Irwell, evidently suggested the design; but the original and commanding abilities of his engineer, that wonderful self-instructed genius, *James Brindley* †, pointed out a much more eligible mode of effecting his purpose, than by means of the waters of a winding brook, subject to the extremes of overflow and drought.

This first undertaking was marked with the features of greatness. At its upper extremity, in Worsley, it buries itself in a hill, which it enters by an arched passage, partly formed by the solid rock, wide enough for the admission of long flat-bottomed boats, which are towed by means of hand-rails on each side. This passage penetrates near three-quarters of a mile before it reaches the first coal-works. It there divides into two channels, one of which goes 500 yards to the right, and the other as far to the left, and may be continued at pleasure. In the passage, at certain distances, air-funnels are cut through the rock, issuing perpendicularly at the top of the hill. The arch at the entrance is about six feet wide, and about five in height from the surface of the water. It widens within, so that in some places the boats may pass each other. To this subterraneous canal, the coals are brought from the pits within the bowels of the hill, in low waggons, holding about a ton each; which, as the work is on the descent, are easily pushed or pulled by a man, along a rail-way, to a stage over the canal, whence they are shot into one of the boats. These boats hold seven or eight tons, and several of them being linked together, are easily drawn out, by the help of the rail, to the mouth of the subterraneous passage, where a large bason is made, serving as a dock. From hence they are sent along the canal to Manchester, in strings, drawn by a horse, or two mules.

---

* From the late Dr. John Aikin's "History of Manchester."

† See an account of him in vol. III, page 246.

It was the principle of this, as it has been that of all Mr. Brindley's canals, to keep on the level as much as possible; whence it has been necessary to carry them over the roads or streams upon arches, after the manner of an aqueduct; and to fill up vallies by artifical mounds for their conveyance, as well as to cut down or bore through hills. The most striking of all the aqueduct works is in this first canal, where it passes over the navigable river Irwell, at Barton bridge. The aqueduct begins upwards of 200 yards from the river, which runs in a valley. Over the river itself, it is conveyed by a stone bridge, of great length and thickness, consisting of three arches; the centre one sixty-three feet wide, and thirty-eight feet above the surface of the water, admitting the largest barges navigating the Irwell to go through it, with masts and sails standing. The spectator was, therefore, here gratified with the extraordinary sight, never before beheld in this country, of one vessel sailing over the top of another! And those who had at first ridiculed the attempt, as equivalent to building a castle in the air, were obliged to join in admiration of the wonderful abilities of the engineer, from whose creative genius, there was scarcely any thing within the reach of possibility, which might not be expected. This work is not the proper place for details of those admirable contrivances, in which every department in the making of his canals have abounded. They have introduced numerous improvements into the practice of similar works, and have received many additions from other ingenious persons, among whom the Duke of Bridgewater's steward, Mr. Gilbert, merits a distinguished place.

This canal, after passing Barton bridge, was conveyed on the level, with great labour and expense, in a circuitous tract of nine miles, to Castlefield, adjacent to Manchester. The most remarkable part of its course, is that where it crosses the low grounds near Stretford, upon a vast mound of earth, of great length, the construction of which exercised all the inventive powers of the conductor. At its termination it is fed by the river Medlock; and in order to keep up the water to a proper height, and prevent a superabundance of it in time of floods, a large circular wear is constructed; having in its centre an aperture, or swallow, which conveys the superfluous water, by a subterraneous passage, into the brook below. Another wear, of a similar kind, is formed at Cornbrook, three miles further. By the act for making this canal, the Duke was limited to a rate of tonnage, not exceeding two and six-pence per ton; and was bound to sell his coals at Manchester and Salford, for no more than four-pence per hundred. On the execution of the undertaking, the poor of those towns were benefitted, by a reduction in the price of coals, of *one-half what they before paid* And vast quantities were taken away by them, from the wharf in Castlefield, in wheel-barrows, at *three-pence halfpenny per hundred.*

But before his first design was completed, a much greater and more important plan had opened itself to the Duke: which was an extension of his canal, by a branch, which running through Cheshire, parallel to the river Mersey, should at length terminate in that river, below the limits of its artificial navigation, and thus afford a new and rival water-carriage, from Manchester and its vicinity, to Liverpool. The execution of this bold idea was authorized by an act of parliament, obtained in 1761, which enabled the Duke of Bridgewater to make a canal from Langford-bridge, in the township of Stretford, to the river Mersey, at a place called the Hempstones, in the township of Halton. It was opposed, but ineffectually, by the proprietors of the old river navigation; on which its operation could not but be highly injurious, however beneficial it might be to the public. This canal, which is more than twenty-nine miles in length, to its termination at Runcorn-gap (which place was preferred to the Hempstones, on account of the superior advantage it offered, in entering the mouth of the canal at neap-tides) was finished in five years. It is carried across the Mersey by an aqueduct bridge, similar to that over the Irwell at Barton; but lower, as the Mersey is not navigable at that part. Further on, it also crosses the small river Bollin, which running in a tract of low meadows, has made a mound in that part, necessary for the conveyance of the canal, of a height, breadth, and length, that forms a spectacle truly stupendous. The principle of keeping the level has been rigorously pursued, in defiance of expence and difficulty; for the whole length of the canal, till it is brought in full view of the Mursey at Runcorn. There it is precipitately lowered ninety-five feet, in a chain of locks, of admirable construction, furnished at different heights with capacious reservoirs of water, in order to supply the waste incurred by the passage of vessels.

When the Duke of Bridgewater undertook this great design, the price of carriage on the river navigation, was twelve shillings a ton, from Manchester to Liverpool; while that of land-carriage is forty shillings the ton. The Duke's charge on his canal was limited to six shillings; and together with the vast superiority in cheapness, it had all the speed and regularity of land-carriage. The articles conveyed by it were likewise much more numerous, than those by the river navigation; besides manufactured goods, and their raw materials; coals, from the Duke's own pits, were deposited in yards, at various parts of the canal, for the supply of Cheshire. Lime, manure, and building materials were carried from place to place; and the markets of Manchester obtained a supply of provisions from districts too remote for the ordinary land conveyances. A branch of useful and profitable carriage, hitherto scarcely known in England, was also undertaken, which was that of passengers. Boats on the model of the Dutch treckschuyts, but more agreeable and spacious, were set up; which at very reasonable rates, and great convenience, carried numbers of persons daily, between Manchester and the principal extent of the canal. All these objects of traffic on the new canal, became, of course, more and more considerable, with the increasing trade of Lancashire.

XIV.—*On the Naturalization of the Cashmeer Shawl-goat in England.* *By* C. T. TOWER, *Esq., of Weald Hall, Essex* *.

SEVERAL attempts have been made to introduce and to naturalize, in the British Islands, the goat of Cashmeer,

---

[*] From Vol. XLVI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its large gold medal to Mr. Tower for a shawl.

that variety of the common goat, or perhaps a peculiar species, the fine wool of which is the material of the so called Indian shawls.

These fabrics, in fineness of fibre, lightness, and warmth, are unrivalled by those of any other material. It has therefore been considered a very desirable object to introduce the shawl-goat, for the purpose of ascertaining whether the climate of Europe is suitable to it; and whether, under these circumstances, the fine wool given it by nature, as a protection against the winter cold of its own country, will be produced unimpaired in the fineness of its staple.

A few years ago some shawl-goats were introduced into Scotland; but the experiment did not succeed, as they died without any progeny.

From France two agents were send to Persia, under the patronage of the Emperor Napoleon, for the purpose of making purchases of goats of the genuine Cashmeer breed, in the province of Caspahan. A considerable number of these animals was procured; and although many of them died in their long march to the coast of the Euxine, and in their passage thence by sea to Perpignan; yet a certain number survived, and were brought to Paris by M. Terneau, in the year 1823.

Mr. Tower happening at that time to be in Paris, purchased four of them, two males, and two females, and succeeded in conveying them safely to his residence in Essex.

The soil of the park at Weald Hall, where they have been kept ever since, is moist, and the situation is much exposed. The animals have, nevertheless, continued in health, and have multiplied rapidly; so that his present flock consists of twenty-seven, including the four original ones. Of these latter, a polled female, which was old when purchased by him, has every year produced at least one kid, and has twice had twins. Those individuals, of which the horns cross, are in Persia esteemed the best; and one of Mr. Tower's last year kids has this peculiarity, They shew no impatience of cold, and are very healthy, requiring only the occasional shelter of a shed, in very rough weather. In spring, summer, and autumn, they graze like sheep; and during winter have been fed with hay, and refuse vegetables from the garden; but their favourite food is gorse *(ulex Europæus)* which they devour eagerly, without being annoyed by its prickles. They damage young plantations, but not more than other goats or deer will do. They breed very early; three of Mr. Tower's goats this year produced kids before they were themselves a twelvemonth old.

A few produce brown wool, but that of far the greater proportion of the goats' is white; and this latter is more valuable than the other.

The coat is a mixture of long coarse hair, and of short fine wool: this latter begins to be loose early in April; and is collected easily and expeditiously, by combing the animals two or three times, with such a comb as is used for horses' manes. A good deal of the long hair comes off at the same time, but the manufacturer has found no difficulty in separating it *. The produce of a male is about four ounces, and of a female about two ounces. Two pounds of wool, as it comes off the goat's back, may be estimated to make one shawl, fifty-four inches square. It will therefore require ten goats, male and female, to furnish materials for one shawl.

Mr. Tower has this year had three shawls made of his wool, one of which was examined by the Committee of Manufactures. The yarn was spun by Messrs. Pease, of Darlington; and was woven by Messrs. Miller and sons, of Paisley. Mr. Tower's shawl was compared with one made in Scotland, of French shawl-goat wool, to which it was evidently far superior. It was also compared with a shawl of M. Terneau's own make; and was considered by very competent judges, to be superior to this also.

---

* A considerable quantity of rough Cashmeer wool was imported from India a few years ago, and baffled the attempts of the manufacturers to disentangle the wool from the hair; probably from the wool having become felted, in conveying it from Cashmeer, and shipping it from Calcutta.

XV.—*On the Preparation of German Silver, Packfond, Argenton, or Electrum: a new Metallic Alloy* *.

This is a new alloy, known by these different names; and is composed of copper nickel and zinc; and which imitates silver sufficiently well, owing to its whiteness, its hardness, and its unalterability.

To manufacture this alloy, which now begins to be much used in Germany, it is necessary to commence, by purifying the *speiss* or *kupfernickel;* an ore which contains, besides nickel, a little cobalt, copper, iron, and much arsenic; and from which it is essential to free it. The Germans have not made known by what means they refine it; but it is probable, that by the aid of roasting, and repeated fusions, they free it from the arsenic. This, however, is certain, that we receive what is termed the *pure nickel,* from Germany, in two different states; namely, in small grains, well fused, and in the form of a coarse black sponge, which has no metallic lustre: they state that neither of these contain any arsenic; nevertheless, they do contain a small portion of it; and in order to employ this alloy with advantage, it would be useful to search for a more exact method of purifying it.

The following are the processes employed in Germany to make *packfond,* as described by M. M. Robert and Co.—This alloy is formed in various proportions; and it is harder, and less liable to alteration, the more nickel it contains. Thus, for example, we may employ one part of nickel, two and three quarters' parts of copper, and three quarters' of a part of zinc. This last alloy is more difficult to work, on account of its hardness; but as it is less liable to alteration, so we should give it the preference for various utensils for culinary purposes, as well as for the laboratory.

---

* From the *Dictionnaire Technologique.*

We must also observe, that the *packfond* is the better, accordingly as the zinc and copper, which enter into its composition, are the more pure; and they affirm, that the presence of a little lead in the zinc, greatly diminishes the malleability of the alloy.

Supposing then, that we are furnished with all the materials properly prepared, and have at command a wind-furnace with good bellows; we commence with pulverizing the spongy nickel, to which we add the necessary proportion of zinc, and place the mixture in a crucible, covering it with the requisite quantity of copper. When the crucible has been thus charged, and well covered, it must be placed in the furnace, upon a foot of baked clay, resting upon the grate of the furnace; the whole must be covered with charcoal, and exposed to the action of the fire. As the spongy nickel also contains some vitreous portions, and we must remove the scorias which float upon the surface; so, when the whole has entered into complete fusion, we must stir the alloy well with an iron rod, and which will also conduce to render the composition uniform in all its parts; we must then pour it into iron moulds, well polished inside, and which will form it into ingots, of about an inch thick. In order that these ingots may be conveniently laminated, we may make them about nine lines thick, nine inches long, and four wide.

However well the process may have been performed, yet we shall find at the summit of the ingot, a depression, occasioned by the contraction of the metal in cooling. Its fracture ought to exhibit a fine and close grain, without any air-holes; otherwise, we should find it, in working, to be a metal full of flaws and cracks.

We shall now give, after M. L. Bauhardt, a process for preparing *packfond*, which differs a little from the above. This consists, in taking thirty-two parts of copper, and eleven parts of nickel, in grains; these are to be put into a covered crucible, and heated until complete fusion takes place; they must then be well stirred with an iron rod, to render the mixture homogenous; and when the whole is in complete liquefaction, it must be poured into water, and granulated; it is then to be well dried, and again placed in the crucible; and when heated to redness, eight parts of zinc are to be added; the whole is then to be covered with a proper defensive flux, and the fire must be urged by a strong blast; and when the whole is well fused, the scorias must be removed, and the alloy be poured into an ingot mould. The alloy thus obtained possesses, according to M. Bauhardt, a great degree of malleability, and is capable of being drawn into fine wire; and it presents the same appearance upon the touch-stone, as silver of fourteen carats.

In order to polish the various articles made of *packfond*, we commence with rubbing them with pummice-stone, next with charcoal, and then burnish them with a hard polished steel burnisher; using at the same time soap and water, or beer. When the burnisher becomes dull, it must be brightened, by rubbing it upon a piece of buffalo-leather, impregnated with putty (oxide of tin and lead).

When there are cavities in the work, into which the pummice-stone cannot be made to penetrate, they may be blanched, by means of a solution of silver, or of tin, diluted with water.

The soldering of the *packfond* requires a great degree of attention in applying the heat, which must be done very gradually, if we would prevent cracks or flaws in it. It is generally soldered with an alloy of the *packfond* with tin; or still better, with fine silver.

In order to clean articles made of *packfond*, we may either use finely sifted wood-ashes, tripoli, or ivory-black, well washed and sifted. R.

Remarks by the EDITOR.

The nickel is chiefly obtained in this country from the Staffordshire potteries, being procured in the extraction of the cobalt blue from its ores. In Parkes's "*Chemical Catechism*," he says, "It is generally said, that nickel has never been brought into use in England; but I have just heard from Birmingham (in 1803) that some of the manufacturers combine it with *iron*, and thus use it with great advantage; and that others melt it with *brass*, in such proportions, as forms a very handsome compound metal, exceedingly useful for many purposes. The Chinese use nickel, in conjunction with copper and zinc, for making various articles.

"According to Proust, nickel used in certain proportions, gives a degree of *whiteness* to iron, diminishes its disposition to rust, and adds to its ductility.

"M. Richter has lately (1803) been occupied in a series of experiments upon nickel. He has found that this metal in its pure state is very malleable, nearly as brilliant as silver, and more attractable by the loadstone than iron. It is generally combined with copper; but he has found a method of freeing it from that metal. He says, that when pure, it is not liable to be altered by the atmosphere; that it is perfectly ductile, and has great tenacity. Its specific gravity, when forged, is 8,666. *Annales de Chimie, tom* III. page 173.

"The most abundant ore of this metal is a sulphuret of nickel, called *kukfernickel*, which is generally a compound of nickel, arsenic, and sulphuret of iron.

"The valuable qualities which M. Richter has discovered in nickel, shew that it might be applied to many important uses; particularly for surgeon's instruments, compass needles, and other such articles, as it is not liable to oxidize by the atmosphere. Should an easy mode of working it ever be discovered, we may possibly find this to be calculated for a greater variety of purposes than any other metal.

"It is a curious circumstance, that all the specimens of the stones which have been said to fall from the atmosphere, *contain iron alloyed with nickel*. These stones, which have at different periods been seen to fall on every quarter of the earth, are supposed by many to be cast from a volcano in the moon. Very lately a shower of them fell in Norway, which covered an extent of three quarters of a league long, and half a league broad.

"Nickel is employed by the Chinese in making their *packfond*, or *white copper*, which is a beautiful metallic compound; but it has not been much used in Europe, although it may be had in considerable quantities."

We see now, however, that it is brought into considerable use in Europe; the Germans having employed it in many ways, and particularly in making the new musical instruments, formerly described by us, and for which it is admirably adapted; as the delicate tongues in them, are easily acted upon by the moisture of the breath, when they are made of steel, brass, or other oxidable metals.

XVI.—*On Making Saltpetre in France, and in Spain.*

By Don Guillermo Bowles.

He states, that he has evident proofs that the basis of nitre really exists in the earth, and in plants, in different provinces of Spain, the same as in the *soda* of Alicant; and that any one may convince themselves of this truth, and see saltpetre with its alkaline basis, in the manufactures of Castile, Arragon, Navarre, Valencia, Murcia, and Andalusia, where it is made without the assistance of vegetable matter; only sometimes throwing in a handful of ashes of mat-weed, merely to filtre the lye of earth; and they make excellent saltpetre by boiling the lixivium of their lands only; consequently, they have gunpowder in Spain, without being indebted for its fixed alkali, to the vegetable kindom, there being a perfect fixed alkali in the earth.

Let us now see how saltpetre is generally made in France, and in Spain; I say nothing of England or Holland, because they make none, importing what they want from the East Indies, where it is found naturally in the earth, as in Spain, where I have seen saltpetre made with the lixivium of nitrous earth, collected in places, where perhaps there never was a tree nor a plant.

Every thing is carried on at Paris, as well as in other parts of France, according to royal ordinances, in the manner I am going to relate:—The rubbish and filth of old houses is carried to the works, and pounded with hammers; the dust is then put into casks, perforated at bottom, the aperture covered with straw, to give a free passage to the liquor. Water is then poured on this dust, which, in its passage, carries away all the saline matter. This impregnated matter is called lye, which, if they were at that period to boil, would produce saltpetre of a greasy nature; to remedy this, they purchase the ashes of all the wood fires in Paris; from which they also draw a lye that is mixed with the former, and they then boil up the whole*. In proportion as the water evaporates, the common salt, which crystallizes when hot, soon falls to the bottom of the cauldron; and the saltpetre, which only crystallizes when cool, remains dissolved in the water. They draw off this water, loaded with saltpetre, into other vessels, and place it in the shade, where the nitre crystallizes. This is called saltpetre of the first boiling, having still some remains of common salt, earth, and greasy matter incorporated with it; it is conveyed to the arsenal to be properly refined, being boiled over again, and left to crystallize two or three times, or more, if found necessary; by which means it is cleared of all its impurities, and becomes perfectly adapted to the making of gunpowder, and the other uses to which it is applied in the arts.

In Spain, where a third part of all the lands, and the very dust on the roads in the eastern and southern part of

---

[*] The fact seems to be this:—The salt they obtain from the lye of the rubbish, is a nitre with an earthy basis; the fixed vegetable alkali procured from the wood ashes is then added; this alkali precipitates the earth from the nitrous acid, and taking its place, forms true saltpetre.

the kingdom, contain natural saltpetre, I have seen them prepare it in the following manner:—

They plough the ground two or three times in winter and spring, near the villages. In August, they pile it up in heaps of twenty and thirty feet high; they fill with this earth a range of vessels, of a conical shape, perforated at the bottom, observing to cover the bottom with mat-weed and a few ashes, two or three fingers deep, that the water may just filtre through. They then pour on the water (sometimes without putting in any ashes); the lye that results from this operation is put into a boiler. The common salt, which, as we said before, precipitates and crystallizes when warm, falls to the bottom, in the proportion of forty per cent.; the liquor is then poured into buckets placed in the shade, where it shoots, and crystallizes into saltpetre. The same earth, deprived of its nitrous quality by this process, is again carried back to the fields, and exposed to the elements; by which means, in the course of a twelvemonth, assisted by the all-powerful and invisible hand of Nature, it again becomes impregnated with a fresh supply of nitre; and what is still more surprising, and cannot be observed, without admiring the wonderful works of the Omnipotent Creator, the same lands have produced for time immemorial, an equal quantity of saltpetre; so that if the Supreme Power was to annihilate all the fictitious saltpetre of France and Germany, Spain alone could supply the rest of the world, without the aid of a fixed alkali, ashes, or vegetables, if public economy joined hands with industry, and assisted in bringing these great points to perfection. I once asked one of these people the reason of that constant production of saltpetre; but his only answer was, "I have two fields, I sow one with corn, and have a crop; I plough the other, and it furnishes me saltpetre!"

XVII.—*On the Spanish Iron Ore of Mondragon, in Guypuscoa; with some Account of the famous Toledo Sword-blades, so greatly valued formerly in England.* By Don GUILLERMO BOWLES.

"I SHALL now relate some particulars concerning the famous iron mine of Mondragon, which is about a league distant from the town of that name, in Guypuscoa. It is called by the Spanish miners, "*Hierro Elado,*" or frozen iron; is found in a red clay, and produces *natural steel,* with this remarkable circumstance, that it is not to be met with any where else in the kingdom. They even preserve a traditional story, that this ore was used for those famous swords, which Catharine of Arragon made a present of to her consort, our Henry the VIIIth; some of which still remain in repute in the highlands of Scotland, being suitable to their dress, and are called *Andre Ferrara,* the name of the maker, which is marked on the blades. *The famous Toledo blades,* those also of Zaragossa, called *Del Perillo,* mentioned in Don Quixote, and others, from the figure of a little dog on the blade *, were also supposed to be made of the ore of this mine, which yields forty per cent. of metal, though rather difficult to fuse. Good steel may be obtained from it with very little trouble, because the iron has in itself the proper disposition to receive in the furnace, the necessary carbon to make excellent blades; but without cementation, it perhaps may not answer for files or razors.

"These blades were generally broad, to wear on horseback, and of great length, suitable to the old Spanish dress; but this being altered, when the Duke of Anjou ascended the throne of Spain, the French swords were introduced with their dress, which even now is commonly called in Spanish, a military dress, *vestido de militar,* in opposition to the long black cloak, universally worn there before that epocha. So that the old Toledo blades fell into disuse, and the manufacture declined; but a new manufacture of sword blades has since been set up at Toledo, for the use of the troops, and they are said to be as well tempered as the old ones, and are able to bear most extraordinary proofs; but these are not made of the ore of Mondragon.

---

* Cervantes endeavours to heighten the courage of Don Quixote, when he attacked the lion in the cage, by adding, "That his sword was of the common sort, and not so sharp as those famous ones with the *Perillo* mark." The Zaragossa artists had three distinct marks on their blades, viz. *El Perillo,* a little dog; *El Morillo,* a Moor's head; and *La Loba,* a wolf. Swords with the *Loba* mark, have the name of *Andre Ferrara* on them, and are not uncommon at this day in England. They show a sword in the small armory of the tower of London, with the name of Andre Ferrara, and no other mark, which was taken in the Scotch rebellion, in 1715.

"There are various opinions relating to the old blades we have been speaking of; some say they were only tempered in winter; and when taken out of the forge for the last time, were vibrated in the air in the coldest weather; others relate, that they were heated till they acquired that colour called *cherry-red,* and then were steeped in a tub of oil or grease, for a moment or two, and then plunged in the same manner into warm water, all which was done in the depth of winter. Others will have it, that they were made of the natural steel of Mondragon, with a list of common iron in the middle, to make them more flexible; and were then tempered in the common manner in the winter season, Such are the prevailing opinions about the blades of Mondragon, which are certainly excellent; but as to the present workmen of Mondragon, or in any part of Guypuscoa, they are yet unacquainted with the secret of converting iron into steel, or tempering it properly; and even in the making of tools, are far inferior to the artists of England.

"It is somewhat particular, that to this day, they have no other word in the Spanish language for a brick-horn, or a bench-vice, than *Vigornia,* the latin name for the city of Worcester, thought to have been once famous for works of that kind.

"As many of the most capital workmen of Toledo quitted that city on the decline of their trade, and settled in different parts of the kingdom, where they supported the reputation of their art; and as their blades have since been dispersed all over Europe, those who are curious in these matters, will, perhaps, not be displeased to see a list of their names; as by this means they may know them whenever they fall in their way:—

Bilboa	Pedro de Lagaretea
Orgaz	Pedro Lopez
Lisbon	Melchior Saanz Juan Martinez Machacha
Seville	Sebastian Hermandez Pedro de Lezama Juan Martinez el Mozo
Madrid	Francisco Alcocer Dionisio Corrientes Antonio Ruiz
Cuenca	Julian Garcia Andres Herraez.
Valladolid	Juan Salcedo
Calatayud	Luis de Nieva Andres Munester
Cordoba	Alonso Rios
Zaragossa	Julian de Rey
San Clemente	Lopez Aguado
Cuellar and Badajos	Bartholome de Nieva Calcado Campanero

“ *The following workmen still remained in Toledo*:—

Zamorano
Thomas de Ayala
Juan de la Horta
Francisco Ruiz and sons
Juan de Vargas
Juan de Luizalde
Francisco Lardi
Andres Garcia

Heras, father, son, and grandson
Alonso de Sahagun and sons
Fernandez
Martinez.

"Any old blades found with these last names, may be undoubtedly considered as true Toledo's, and executed by the most capital artists.

"Cervantes further relates, that Ramon de Hoces was famous at Seville for making of poinards. Nor should I forget the famous *Montante* of Spain, a huge weapon, used with both hands, at once so well described by Milton, speaking of Michael's sword:—

> "With huge two handed sway
> Brandished aloft, the horrid edge came down,
> Wide wasting."
>
> PARAD. LOST. Book VI.

"In the king's armory at Madrid, besides many curious and complete suits of armour, they had a fine collection of antique swords; amongst the rest those, said to have belonged to the Cid, and Bernardo del Carpio; also the sword of Francis I., and that of John George, Duke of Saxe-Weimar, taken from him by Charles V., at the battle of Horlingen. The swords of the Cid, and Bernardo del Carpio, were made at Zaragossa; but that of Francis, at Valencia; as was the sword, likewise in the armory, of that famous hero, Garcia de Paredes, with his name on the blade, and on the other side, "*plus ultra operibus credite.*" Though these details may now, perhaps, be considered as of little moment, it was not so with our ancestors, who set a high value on these Spanish sword-blades, particularly the Toledo's; as may be collected from various passages in our favourite writers,—Shakspear, Johnson, and Butler."

XVIII.—*On the Spanish Iron Mine, and Forges, at Somorrostro, in Biscay.* *By Don* GUILLERMO BOWLES.

THE famous iron mine, at Somorrostro, in Biscay, has all the appearance of being alluvial, and originally formed by the combination of some fluid matter, increasing by insensible degrees, and reduced into a lamellated state; it successively forming plates or scales, one over the other, thinner than paper; as is evident, from the many concavities and crevices covered over with these plates; and which, supposing it to be the case, we need not therefore be surprised at what has been advanced by some of the workmen; who assure us, that they have often found broken pieces of pickaxes, mattocks, and other instruments, in places that had been worked centuries ago, and are now replete with new ore. If this is a fact, we may further believe them, when they assert, that the mine increases; though the slow progress of nature, in this operation, does not permit us to calculate its gradation; or to determine the number of ages, sufficient to fill up a cavity of any given size.

From the above, it results that a solution, evaporation, alluvion, and deposition, all exist in the mine. Its situation is an undulated hill, which, when viewed from the mountains, seems almost a plain. Its form is regular, and one may go round it in about four or five hours. The ore forms an uninterrupted stratum, whose thickness varies from three feet to ten; and is covered with a coat of whitish calcareous rock, from two to six feet thick. When the ore is taken out of the mine, it has the colour of bull's blood, and when wetted becomes purple; great quantities of it are carried away by water to the neighbouring provinces; where they either fuse it by itself, or mix it with ore of their own, which generally yields a harder iron. I shall only speak of their process with that ore which is fused without any mixture.

The first operation is to roast it in the open air, by piling strata alternately of ore and wood, in order to divide the ore, drive off the moisture, and diminish its weight; that it may be more easily fused, and the ferruginous parts separated from the slag. When it is sufficiently roasted, they put it into a furnace, with the due proportion of charcoal, and when it appears to have fused, by leaving on the hearth a mass of four of five arrobes, of 25lb. each, they lay hold of it with tongs, and place it on an anvil, under an immense hammer, of from about seven hundred to a thousand pounds weight, and there, by force of blows, and moving it about, they square it, and reduce it into bars. The bar thus shaped, may be doubled or lengthened in a lesser forge, if they please, *and even beaten cold, as if it was silver!* In this manner the ore is fused in a few hours, and the bars formed, and sold to the blacksmiths. Formerly the iron was beat by mere strength of arm, a proof of which may be gathered from the names of many places in Biscay, situated where there is neither river nor brook, and begin or end, with *ola* or *olea,* either of which in the Biscay language, signifies iron-works; such as *Mendiola,* that is, "iron-works of the mountain."

According to appearance, 100 pounds of ore will produce about 35lb. of good iron. As this ore neither contains sulphur nor acids, it is not necessary to mix any calcareous substance with it to fuse it, in order to absorb those matters, so troublesome in ores that have the misfortune to be loaded with them, as is often the case in France and other countries. However, it would not be amiss to use a little of it, were it only to assist the fusion of the ferruginous earth, accelerate the process, and lessen the slag, as well as the quantity of fuel. These workmen have acquired, by constant experience, the proper method of managing the ore, as well as to know the quantity of coal for the furnace or forge, which is seldom larger than that of a considerable blacksmith; so that little improvement can be made on their labours. A good forge, well conducted, will yield to the owner about five hundred ducats a year;

some indeed hardly produce three hundred after paying all charges. It is necessary for them to be good economists with respect to fuel, and to use small forges; for if they were to have such large ones as are common in most parts of Europe, with all the apparatus of hammers and other implements, they would soon strip their mountains of wood, and the forges would be at a stand for want of materials.

XIX.—*On the German Polish for Wood.*

We were the first to publish any accurate information on the *French polish* for wood, now become so universally employed, in our *Technical Repository*, from information derived from Mr. Joseph Clement, the celebrated engineer; and have continually added, from time to time, such further particulars thereon as have come to our knowledge.

Our scientific friend, Mr. J. I. Hawkins, however, having lately returned from Vienna, where he saw this process performed by an excellent workman in the cabinet-making line, and where it was invented forty years since, has kindly furnished us with such valuable information on *their superior method* of performing it, that we lose no time in communicating it to our readers.

The wood having been planed flat, and finished with the steel scraper, as in the usual processes for the French polish, has its surface evened as follows: Two pieces of pumice-stone, having been previously rubbed flat, are then to be oiled, and rubbed against each other, until they have acquired an uniform or even surface. The wood is then to be well rubbed with these, first longitudinally, then across, and finally in a spiral or circular manner, always obliterating or removing the scratches or marks made by the former rubbings, before finishing the succeeding ones; in this manner the surface of the wood will likewise receive an uniform surface, and will become ready for the application of the varnish.

The Germans never use any other varnish, than a rather dilute solution of seed-lac, or shell-lac, in alcohol, for their *polish;* and indeed the addition of any other material would only injure *the great hardness of the lac varnish.* If the varnish be required of *a lighter colour* than usual, in this case the clearest grains of lac ought to be selected in preference.

The varnish is applied in the following manner. A piece of *sponge* being wetted with the varnish, is to be laid upon *five pieces of linen rag,* the borders or edges of them being gathered together at the back, to serve as a handle to this rubber. When the varnish has penetrated all though these different thicknesses of linen cloth, a little linseed oil must be applied in the midst of the varnish. *The whole extent of one surface of the article to be polished, must then be gone over at once,* with this rubber; the varnish being also applied, first in straight lines crossing each other, and then in spiral or circular ones, in the same manner as in the evening the surface of the wood; and fresh oil must be applied to the centre of the rubber, whenever a tackiness or adherence of the varnish is beginning to take place. If there are four or five different articles to be polished, each should be gone over in succession, in the above manner, and thus afford time for the varnish to acquire consistence, before applying another coat of it upon the former ones. In this way the process must be continued, with the usual care and precaution, until it is thought that nearly enough varnish has been applied to the surfaces. One of the linen rags is now to be taken off, and the varnishing continued with the remaining four, with a renewed surface, and the application of the oil upon the outer one; this again is then to be removed in its turn, and the process carried on towards completion with four thicknesses only; then with three; with two; and finally, with one thickness of linen only.

Should the varnish be required to be of any other colour than that afforded by the lac, it may be *reddened,* by filing a little *Brazil* wood, and sprinkling the sponge over with the dust; changed *yellow*, by treating *turmeric root* in the same manner, and so with other tinging woods, the colour of which is capable of being brought out by the action of alcohol upon them.

Should, however, it be required, that *a still more durable polish* be given to the wood; then the above process must be repeated at the end of two days after the first polish has been given to it; next, in the course of a week; again at at the end of a month; and lastly, at the end of three months; thus always allowing due time for the previous coats to become sufficiently hard, before applying the succeeding ones. In this manner, instead of having to lament the quick disappearance of this beautiful polish, as in the ordinary French method of doing it; we may calculate upon its enduring for years.

The German cabinet-makers do not merely content themselves with polishing the exterior of their works, but extend this beautiful improvement to the drawers, partitions, and every other part of their interior fittings also, with great addition to their value.; and indeed they also take much more care in the finishing of their woods generally, than we are in the habit of doing.

XX.—*On an American Improvement in Turning Lathes.*

WITH FIGURES.

THIS improvement consists in a superior mode of fitting screw chucks upon the mandrel of the lathe, so as to ensure their being central, and running true.

In general, we are content with fitting the chucks accurately upon the screwed end of the mandrel, and against the flat end of its shoulder; but this is not sufficient to ensure their always running truly. In an American lathe, lately shewn us by a Mr. Saxton, of Philadelphia, (a friend of Mr. J. Lukens's, whose various improvements are already well known to our readers,) there is a cylindrical part *a*, plate II. fig. 22, formed upon the nose of the mandrel, close adjoining to the flat end or shoulder of it, *b*; and upon which, a cylindrical part, formed in the outer end of the screwed hole in each chuck, as at *c*, is accurately fitted. By this means the chucks are constantly preserved central in use. The cylindrical part should be rather larger in diameter than the tops of the threads of the screw.

Mr. Saxton's lathe is a similar one to that of Mr. Lukens's, described by us in vol. XI. page 304, of The *Technical Repository*; but with other improvements, which we may possibly be enabled to lay before our readers.

XXI.—*On an Instrument to assist the Deaf.*—*By* Mr. POINTER, *Surgeon, &c., Camden Town.*

WITH FIGURES.

THIS instrument consists of a flexible tube, from two to six feet in length, and half an inch in diameter, having an ivory cup or mouth-piece at one end of it; and another ivory piece, rounded at its end, to enter the ear, affixed to its other end, as shewn in plate II. fig. 23; this latter piece may be straight, as shewn in fig. 23; or be bent at an angle, as represented in fig. 24. When either of these latter-mentioned pieces are placed in the external opening of the ear, any words spoken, even in a low tone, into the cupped end, will be audible at the other end. A conversation may thus be held in a room full of company, between two persons, without the others having any knowledge of what is said. But in this case, two of the instruments ought to be employed, especially if the parties are at any distance from each other, in order to avoid the inconvenience of reversing the ends of the instrument, as must be done where only one is used.

This is a very convenient and ingenious application, of the well-known conducting powers of tubes for sound; and the instruments may be afforded at a very moderate price. Mr. Pointer has also contrived the means of affixing and supporting them upon a table, so as to be very readily applied when required.

XXII.—*On the Locusts of Spain.* *By Don* GUILLERMO BOWLES.

THE locusts of which I am now going to speak, are continually seen in the southern parts of Spain, particularly in the pastures, and remote uncultivated district of Estremadura; but in general are not taken notice of, if not very numerous, as they commonly feed upon wild herbs, without preying upon gardens and cultivated lands, or making their way into houses. The peasants look at them with indifference while they are frisking about the fields, neglecting any measure to destroy them till the danger is imminent, and the favourable moment to remedy the evil is elapsed.

Their yearly number is not very considerable, as the males are far more numerous than the females. If an equal proportion was allowed, only for ten years, their numbers would be so great, as to destroy the whole vegetative system. Beasts and birds would starve for want of subsistence, and even mankind would become a prey to their ravenous appetites. In 1754, their increase was so great from the multitude of females, that all La Mancha and Portugal were covered with them, and totally ravaged. The horrors of famine were spread even further, and assailed the fruitful provinces of Andalusia, Murcia, and Valencia.

The amours of these creatures are objects of surprise and astonishment. The male retires to the water afterwards, where he soon perishes, and becomes an easy prey to the fish. The female spends the remainder of her days in some solitary place, busy in forming a retreat under ground, where she can secure her eggs, of which she generally lays about forty, screening them by her sagacity from the intemperature of the air, as well as the more immediate danger of the plough or the spade, one fatal blow of which would destroy all the hopes of a rising generation.

The manner of her building her cell is equally surprising. In the hinder part of her body, Nature has provided her with a round smooth instrument, eight lines in length, which at its head is as big as a writing quill, diminishing to a sharp point, hollow within, with an aperture in it like the tooth of a viper, but only to be seen with a lens. At the root of this vehicle there is a cavity, with a kind of bladder, containing a glutinous matter, of the same colour, but without the consistency or tenacity of that of the silkworm, as I found by an experiment made for the purpose, by an infusion in vinegar, for several days, without effect.

The orifice of the bladder corresponds exactly with the instrument which serves to eject the glutinous matter; it is hid under the skin of the belly, and its interior surface is united to the moveable parts of the belly, and can partake of its motions, forming the most admirable contexture for every parts of its operations; as she can dispose of this ingredient at pleasure, and eject the fluid, which has three very essential properties: first, being indissoluble in water, it prevents the young from being drowned; next, it resists the heat of the sun, otherwise the structure would give way, and destroy its inhabitants; lastly, it is proof against the frost of winter, so as to preserve a necessary warmth within.

Having spent many hours and days in observing the labours of the locust, I shall now proceed to describe them. The female begins, by stretching out her six legs, fixing her claws in the ground, and holding with her teeth to the grass; she then expands her wings, to press her chest close to the ground, where clinging firmly, and raising that part of the belly where she has the instrument mentioned before; after forming a right-angle with her body, she fixes it with such strength, that it fastens to the hardest earth; she has all the necessary apparatus to make a perforation; but this alone would not answer her purpose, a place being still wanted, properly lined, wherein she may deposit her eggs.

This hollow cavity is made in about two hours; she then begins to shift the earth underneath, and emits the glutinous substance. Having thus kneaded the earth into a substantial paste, and smoothed the floor with her trunk, she lays the first egg; then renews the operation, and lays more, with admirable order; and after various repetitions, completes the whole in about four or five hours; next covering over the superior aperture also with a glutinous composition, the structure is perfect, and is provided with every advantage for resisting the inclemency of the weather.

The female is now overcome with fatigue, few having strength, like the male, to seek after refreshing waters; but exhausted and spent, they expire close to their progeny, exhibiting a melancholy sight to the husbandman; who, from their appearance, foretells the mischiefs to follow, without being able to prevent them; forming an idea of the hidden enemies, who are to devour his harvest, from the multitude of carcases he finds dispersed in the fields.

The egg which encloses the embryo, has the same cylindrical shape as the repository it is laid in, being a membranceous cylinder, one line long, and very white and smooth. The eggs are placed aside each other, rather obliquely, the head, as in others, being nearest the part where it is to come out. The time of hatching varies according to climate, those that are in high and mountainous places being generally later than those on the plains. I saw legions of them skipping about in Almeria in February, because the climate is so mild there, that most kinds of greens are nearly over at that time. In Sierra Nevada they only begin to appear in April; and in La Mancha they were hardly animated in May, when there were no greens yet in the market of San Clemente. So that they form a certain thermometer to judge by of the warmth of the air. From these various situations proceed those immense swarms of locusts, which appear successively in June, July, and August.

When they first come out of the egg they are black, of the size of a gnat, and gather in great heaps at the feet of shrubs, and particularly of the *spartum*, or mat-weed, continually leaping upon each other, and occupy a space of three or four feet in circumference, and two inches high. The first time I beheld this sight it surprised me exceedingly, to observe this moving body like a mourning scarf, waving about. For a few days they move to a very little distance, their limbs being weak, their wings very small, and their teeth not sufficiently strong to bite the grass. In about twenty days they begin to feed on the youngest shoots of plants; and as they grow larger, they leave the society of each other, and range further off, consuming day and night every thing they fix upon, till their wings have acquired a full degree of strength. In the mean time they seem to devour, not so much from a ravenous appetite, as from a rage of destroying every thing that comes in their way. It is not surprising that they should be fond of the most juicy plants and fruits, such as melons, and all manner of garden fruits and herbs; feeding also upon aromatic plants, such as lavender, thyme, rosemary, &c. which are so common in Spain, that they serve to heat ovens; but it is very singular, that they equally eat mustard, onions, and garlic; nay, even feed upon hemlock, and the most rank and poisonous plants, such as the thorn-apple, and the deadly nightshade! They will even prey upon *crowfoot, whose causticity burns the very hides of beasts;* and such is their universal taste, that they do not prefer the innocent mallow to the bitter furze, rue, or wormwood; consuming all alike, without predilection or favour! Naturalists may search for their motives, which I am at a loss to discover; the more, as I saw millions of them light on a field near Almaden, and devour the woollen and linen garments of the peasants, which were lying to dry upon the ground. The curate of the village, a man of veracity, at whose house I was, assured me, that a tremendous body of them entered the church, and devoured all the silk vestments, not even sparing the varnish on the altars.

Out of curiosity, to know the nature of so formidable a creature, I was urged to examine all its parts with the utmost exactness. Its head is of the size of a pea, though longer, its forehead pointing downwards, its mouth large and open, its eyes black and rolling, with a timid aspect, not unlike a hare. With such a dastardly countenance, who would imagine this creature to be the scourge of mankind! In its two jaws it has four incisive teeth, whose sharp points traverse each other like scissars, their mechanism being such, as either to gripe or to cut. Thus armed, what can resist a legion of such enemies; after devouring the vegetable kingdom, were they in proportion to their numbers, to become carnivorous, like wasps, they would be able to destroy whole flocks of sheep; and even the dogs and shepherds; just as we are told of ants in America, that will overcome the fiercest serpents.

The locust spends the months of April, May, and June, in the place of its birth; at the end of June its wings have a fine rose colour, and its body is strong. Being then in their prime, they assemble for the last time to propagate their species. About ten o'clock, when the warmth of the sun has cleared their wings from the dampness of the night, they rise five hundred feet high, forming a black cloud, that darkens the rays of the sun. The clear atmosphere of Spain becomes gloomy, and the finest summer day of Estremadura more dismal than the winter of Holland. The rustling of so many millions of wings in the air, seems like the trees of a forest agitated by the wind. The first direction of this formidable column is always against the wind; which, if the wind is not too strong, will extend about two leagues; they then make a halt, when the most dreadful havoc begins; their sense of smelling being so delicate, that they can find at that distance a corn-field or garden; and after demolishing them, they rise again in pursuit of others; this may be said to be done in an instant. Each seems to have, as it were, four arms and two feet; the males climb up the plants, as sailors do up the shrouds of a ship; they nip off the tenderest buds, which fall to the females below. At last, after repeated devastations, they alight upon the ground, and the females prepare for laying their eggs.

We learn by tradition, as well as from history, that the locusts have been a plague to the meridional provinces of Spain time immemorial. I once saw a cloud of them pass over Malaga, and move towards the sea, and go over it for about a quarter of a league, to the great joy of the inhabitants, who concluded they soon would be drowned. But to their disappointment, they suddenly veered about towards the coast, and pitched upon an uncultivated space, surrounded with vineyards, which they soon after quitted. When once they appear, let the number demolished be ever so great, the proportion remaining is still too considerable; therefore, the only way to put an end to such a calamity, would be to attack them beforehand, and destroy their eggs.

XXIII.—*On the Manufacture of French Articles of Perfumery* [*].

The art of the perfumer is derived, according to some historians, from the most remote periods. Diodorus of Sicily pretends, that the Egyptian priests were the only possessors of the necessary recipes for embalming dead bodies.

---

[*] From the *Dictionnaire Technologique*.

The number of these articles of perfumery is now-a-days become very considerable.

The business of the perfumer consists in the preparation of the various products which we shall hereafter mention, and which are divided into two classes: namely, the perfumes from Grasse, and those of Paris. The first and most important branch comprehends the fabrication of the prime materials, and which should be done in the localities where they are produced; and the second also merits attention, from the immense consumption of articles in perfumery.

THE PERFUMES FROM GRASSE, IN THE DEPARTMENT OF VAR.

Preparation of the fats of the pommades by infusion, and of those made without infusion; of oils; on distillation; and on the extraction of essential oils or essences.—Grasse, from the mildness of its climate, is one of the finest towns in Provence, the natural soil of the aromatic plants. Numerous and various kinds of flowers grow in such abundance there, as to require but little care in their culture. Amongst those ordinarily grown at Grasse, we may enumerate the following: the jasmine, the rose, the violet, the tube-rose, and the jonquille. It is to be regretted, that amongst the number we cannot also find the orange, the citron, the hyacinth, the mignonette, the heliotrope, which would double the revenues of the proprietors; but we suppose that there exist causes which oppose their vegetation. Not two leagues from thence, in the small village of Canet, they collect various kinds of flowers, of which the annual product cannot be less, on a moderate estimation, than two hundred thousand francs!

Before describing the processes employed in the fabrication of the perfumeries of Grasse, we must give an idea of the mode of preparing the fatty materials. These take the precedence before all others; as from them are prepared a great part of the perfumeries of Grasse, as well as those of Paris.

The perfumer employs in the whole three kinds of fat: namely, that of pork, beef, and mutton. The modes of preparing them differ but little from those in common use; but it is necessary, nevertheless, to make known the changes and improvements which the perfumers have latterly made in their manipulations; and which relate only to the fats of pork and mutton. The first is pounded and beaten in an iron mortar, after having previously cut it small with a hatchet or cleaver; and the second must be carefully freed from all the fleshy parts before subjecting it to the action of heat.

When thus prepared the fats are pure, and of a perfect whiteness; but care must be taken that the time employed in preparing them be not too much prolonged, lest they might begin to putrefy. This quick alteration may also be owing to their retaining some portion of water (an inconvenience difficult to avoid, as in evaporating them sufficiently to drive off the last portions of water, they risk the decomposition of part of the fatty matter also). The perfumers have for several years past adopted the following process, which appears preferable. They pound the fats without the addition of any water, until all the membranaceous parts are completely separated; they then throw this prepared mass into a boiler, heated by a *balneum-marie* or water-bath. The fat being perfectly melted, the albumen in the blood coagulates, and entangles all the other foreign or extraneous matters; the scum which forms must be carefully removed, and the whole remainder be afterwards passed through a canvass strainer.

ON THE POMMADES MADE BY INFUSION.

Rose, orange-flowers, and cassia.—They take 334 pounds of prepared hog's-lard, and 166 of beef-suet. (The third part of beef-suet which is here added, is intended to give more consistence to the pommade, and especially when it is to be exported to warm climates.) These 500 pounds of prepared fat are to be put into a vessel, termed a *bugadier;* they then add 150 pounds of rose-leaves, which they throw upon the melted fat, and carefully stir them for several hours. This infusion, thus prepared, must remain at rest for twenty-four hours; at the end of this time, the pommade is again melted, and continually stirred, in order that none of the rose-leaves may adhere to the bottom of the vessel; when melted, it is strained through canvass, in which operation the *marc* or dregs take the form of rectangular loaves; these loaves are placed under a press, in order to extract all the remains of the fat from the solid parts. The loaves are held in a barrel, pierced full of holes, and bound with iron, so that the pommade may escape on all sides, and fall into a copper vessel placed under the gutter or spout to receive it.

This operation is repeated many times, in order to avoid the loss which results from the small quantity of pommade which the canvass ordinarily retains. This work, simple as it appears, nevertheless demands great care; and the workman who executes it, can only acquire by practice a perfect knowledge of it.

This process is repeated, with the same fat, ten or twelve times; and thus they employ 3000 pounds of rose-leaves to make a good pommade.

The orange-flower pommade is made in the same manner, but it requires still greater care to be taken in pressing it, in order to make it clear, as it is liable to form a deposit.

In preparing the orange-flowers, they remove the yellow parts of them, when they intend to produce a white pommade; but, unfortunately, their high price prevents them from often practising this method. The pommade, thus prepared, costs at least thirty francs the pound; but it is imcomparable as a perfume.

We shall not enter into the details relative to the preparation of the *pommade of Cassia,* as it is made in the same manner as the two preceding ones.

ON THE POMMADES MADE WITHOUT INFUSION.

Jasmine, tube-rose, jonquille, narcissus, and violet.—We take a double dish, termed a *tiame*, and pour into it twelve ounces of the prepared fats of pork and beef, the flowers being contained in the other part; next day these are removed, and replaced by fresh flowers; this process is continued for two or three months, or until the pommade has attained the degree of perfume designed to be given to it. This work requires great care and patience, as the jasmine flowers contain other matters prejudicial to the required scent, which require them to be removed every day; and without taking this precaution, the pommade would become defective.

Some perfumers, nevertheless, employ fusion for making this kind of pommade; but we think it ought to be discontinued entirely, as it cannot but injure this delicate pommade. Lately, M. Thias, of Grasse, has contrived to substitute for the *tiames*, frames composed of four pieces of wood perfectly united, into which he puts a glass vessel, containing the pommade, spread over it with a palette-knife. This is an advantageous improvement, as the room which the *tiames* occupied was considerable, and their great weight was also an obstacle to their superposition. Now these frames can replace them, and the perfumers require four thousand of them for their establishments. The frames are placed one above the other, and a cover is placed over the uppermost one, to hinder the access of the external air. This work is sufficiently curious to attract the attention of travellers, who find a pleasure in visiting the laboratories of the principal manufacturing houses of Grasse.

ON PERFUMED OILS.

The oils of roses, orange-flowers, and cassia.—These are made by infusion, like the pommades of the same odours; and it is an indispensable precaution, that we choose oils which are perfectly fresh; for those of *jasmine, tube-rose,* *jonquille, and violet*; and, in general, of all delicate flowers the following is the process :—

They place, on an iron frame, a cotton cloth, imbibed with olive oil of the first quality, and which they completely cover with the flowers. This layer must be but of little thickness. They continue this process, changing the flowers until the oil is saturated with the odour which they desire to communicate to it; at the end of this time, which we can easily conceive must be variable, they submit the cloths to the action of a press. This last part of the process usually occupies eight entire days.

ON DISTILLATION.

The essential oils or essences obtained in the south of France are those of *roses, neroli, petit-grain, lavender, wild-thyme, thyme, and rosemary.*

These essences are distilled in the usual manner. They obtain, by putting into the body of the still forty pounds of rose-leaves, and thirty pints (French) of water, and proceeding to distillation, fifteen pints of rose-water. They then continue the operation until they have thus obtained 200 pints of water, termed No. 1. In this first distillation, they obtain an almost imperceptible quantity of the *essence of roses*; but in the second it becomes more apparent; and, finally, in the fifth it becomes notable.

The house of Langier, senior and junior, annually make 250 ounces of essence of roses.

In the distillation of *orange-flowers,* they also obtain the *essence of neroli,* now become of remarkable importance. If they would obtain this essence they follow the ordinary process, and repass the waters of the first distillations upon new flowers. On the contrary, when it is intended to prepare orange-flower water of a good quality, they draw off a fifth part only of the water placed in the cucurbit.

The essence de petit-grain is obtained by distilling the leaves of the orange-tree; the quantity of essence they afford depends upon their freshness. With respect to those of lavender, wild-thyme, thyme, and rosemary, they present no peculiarities in their extraction.

ON SPIRITUOUS ESSENCES.

Rose, orange, jasmine, tube-rose, cassia, violet, and other flowers.—They take three water-baths, furnished with covers, and put into one of them twenty-five pounds of one of the perfumed oils above-mentioned, and twenty-five litres of spirit, marking three-sixths; they stir the whole every three quarters of an hour during three days; at the end of this time they decant the spirit thus perfumed, and pour it anew into the second water-bath; they again repeat the same operation in the third bath, and the spirit then obtained is perfected. By continuing the process with the same oil, they likewise obtain inferior qualities, and which they indicate under the terms, No. 2, 3, and 4.

Some perfumers pretend that they can replace these oils with advantage, by employing pommades strongly impregnated with odours; we cannot say to which of the two the preference ought to be given, as they obtain by both processes similar results.

Spirit of sweets.

7 *litres** spirit of jasmine, third operation
7 *litres* spirit of Cassia, third ditto
3 *litres* spirit of three-sixths
2 *litres* spirit of tube-rose, third operation
1½ ounces of essence of cloves
½ an ounce of fine neroli
1½ ounce of essence of bergamotte
8 ounces of musk, second infusion
3 *litres* of rose-water.

Italian spirit of flowers.

2 *litres* spirit of jasmine, second operation
2 *litres* spirit of roses, second operation

---

* The *litre* is nearly two and one-eighth English wine pints.

2 *litres* spirit of oranges, third operation
2 *litres* spirit of cassia, second operation
1½ *litres* of orange-flower water.

Spirit of Cytherea.

1 *litre* of spirit of violets *
1 *litre* of spirit of jasmine, second operation
1 *litre* of spirit of tube-rose, second operation
1 *litre* of spirit of pinks
1 *litre* of spirit of roses, second operation
1 *litre* of spirit of Portugal
2 *litres* of orange-flower water.

PERFUMERIES OF PARIS.

Of Pommades.—We can reckon twenty-seven pommades to which flowers give their odour. This last kind of pommades is an imitation of those flowers which are not cultivated in France. The essences usually employed in making of pommades are those of *bergamotte,* citron, *cedrat, limette,* Portugal, rosemary, thyme, wild-thyme, lavender, marjorum, and cinnamon.

We divide these pommades into three qualities:—
Fine pommade
Superfine pommade
Roman pommade.

As this last requires particular care, we shall indicate the preparation of the *pommade à la Vanille,* termed *Roman*:

12 pounds pommade of roses
12 pounds oil of roses
1 pound *Vanille,* first quality, pulverized
6 ounces of *bergamotte.*

The pommade must be melted in a water-bath; the vanille is then to be thrown in, and stirred continually for an hour; it is then left at rest for two hours; this time is sufficient for the vanille to be completely deposited; the clear part is then to be drawn off, and the pommade thus formed will be of a yellow colour, which is much preferable to that of the ordinary brown colour.

---

* These spirits usually mark 28° of the *alcoometre.*

We must here make an observation relative to the odorous extracts and waters. We should always employ in preference the spirits of flowers; which ought to be prepared by first macerating the flowers in the alcohol, and then adding the different essences necessary to give the perfume the required odour. Unfortunately, they often neglect to perform this necessary operation. These spirits of flowers ought always to form the bases of good perfumes.

ODOROUS EXTRACTS.

The alcohometric degree of the spirit employed for these, however variable, should always exceed 28 degrees.

Extrait de Bouquet.

2 *litres* spirit of jasmine, first operation
2 *litres* extract of violets
1 *litre* spirit of cassia, first operation
1 *litre* spirit of roses, first operation
1 *litre* spirit of oranges, first operation
1 *litre* extract of pinks
4 *gros* of benzoin
8 ounces of essence of amber.

Extract of Peach Blossoms.

6 *litres* of spirit, at three-sixths
6 pounds bitter almonds
2 *litres* spirit of orange-flowers, second operation
4 *gros essence de laurier amande*
4 *gros* balsam of Peru
4 ounces essence of citron.

EAUX DE COLOGNE.

There are two processes which are equally employed in the preparation of *eaux de cologne;* namely, distillation and infusion.

The first is now generally abandoned; but it is, nevertheless, beyond contradiction, the preferable one.

The only essences which are employed, and which afford this water its great celebrity, are the following: *bergamotte,* citron, lavender, rosemary, Portugal, and *neroli.* All these should be of the first quality; but their proportions may be varied according to the choice of the consumers.

The lavender waters are now indeed but little esteemed; nevertheless, for their virtues, they are in daily use; they ought always to be prepared from the fresh flowers, and not by a solution of the essence of lavender in alcohol.

ODOROUS WATERS OF LAVENDER, HONEY, VULNERARY, AND ARQUEBUSADE.

We can reckon, in articles of perfumery, thirty different odours; these are varied according to the choice and skill of the manufacturer. We shall content ourselves with giving the recipes for the three following ones. Amongst these will be found the *English honey-water,* but which we now manufacture with great succees.

HONEY-WATER.

6 *litres* of spirit of roses, third operation
3 *litres* of spirit of jasmine
3 *litres* of spirit, of three-sixths
3 ounces of essence of Portugal
4 *gros* flowers of benzoin
12 ounces essence of vanille, third infusion
12 ounces essence of musk, third infusion
3 *litres* of orange-flower water, of a good quality.

Eau de Mille Fleurs.

18 *litres* of spirit of three-sixths
4 ounces of balsam of Peru
8 ounces of essence of *bergamotte*
4 ounces of essence of cloves
1 ounce of essence of ordinary neroli

1 ounce of essence of thyme
8 ounces of essence of musk, third infusion
4⅓ *litres* orange-flower water.

Eau de Mousseline.

2 *litres* spirit of roses, third operation
2 *litres* spirit of jasmine, fourth operation
1 *litre* spirit of pinks
2 *litres* spirit of orange-flowers, fourth operation
2 ounces essence of vanille, third infusion
2 ounces essence of musk, third infusion
4 *gros* essence of sandal-wood
1 *litre* orange flower-water.

All these three waters should mark twenty-four degrees. As they possess similar properties, we shall pass them over in silence.

Lately, M. M. Langier have invented two new waters; one of these is named *eau de Langier,* and the other *eau anti-pestilentielle.* This last is principally intended to remove the disagreeable odours which are produced whenever the chlorates are made use of.

Dentrifice Waters.

We shall indicate those of these waters which are most known.

Eaux de Grenouch, balsamique, dentrifice et rose èthérée.—Some persons prefer to use powders; but they are always hurtful, on account of the cream of tartar which they contain.

Eau Balsamique Ethérée.

3 *litres* of spirit of three-sixths
2 *gros* of spirit of mint
2 *gros* spirit of neroli, best quality,
2 *gros* spirit of cinnamon
2 *gros* spirit of amber
1 *gros* of sulphuric ether.

Put them into a matras, and infuse them in a water-bath for eight days.

Eau Balsamique.

18	*litres* of spirit of three-sixths
1½	*litres* of spirit of cochlearia
1½	*litres* of spirit vulnerary
9	pounds of cloves
12	pounds of the roots of *pirette*
12	pounds of fine cinnamon
3	pounds of starry anise-seeds
2	*gros* of saffron
4	*gros* of fine spirit of mint.

Essence à Détacher, Parfumée.

3	*litres* of spirit of three-sixths
1	pound of white soap
1	pound of ox-gall
1	ounce of essence of citron
2	ounces of essence of mint

There are two essences equally employed for this purpose; the one is termed *essence de citron, and* the other *essence nouvelle à détacher;* both of the two have the advantage of being without any other smell.

ALMOND PASTE.

These are divided into three kinds, but are all prepared nearly in a similar way; namely, brown almond paste, white sweet almond paste, and white bitter almond paste.

The first is made of the kernels taken out of apricot stones, as also with almonds; these are formed into loaves, weighing five or six pounds each, and are then subjected to pressure, in order to extract the oil (300 pounds of almonds will yield about 130 of oil). The press is turned or squeezed closer every two hours, during three days; at the end of this time the loaves are withdrawn from the press, when they are dried, in order to be pounded; and lastly are passed through a sieve.

The second kind is obtained by scalding the sweet almonds in boiling water, until their skins become completely detached; they are then put into a basket and cooled, and the skins entirely separated; when they are become dry, they are subjected to the same processes as the preceding.

The third kind is prepared as the second is, only that bitter almonds are made use of.

(To be continued.)

XXIV.—*On New Detonating Caps* *.

THE carbo-azotic acid *(Kohlenstickstoffsæure)* discovered by professor Liebig, affords with lead, a combination, which detonates when it is compressed between two pieces of iron. This combination has the advantage of being less dangerous than fulminating mercury, for the preparation of the detonating caps. To obtain the carbo-azotic acid in a perfect state of purity, we gently heat, after first powdering it, East Indian or South American indigo, of the best quality, with eight or ten times its weight of nitric acid. As it dissolves, it disengages a great quantity of nitrous acid fumes, and produces a considerable effervescence. When the scum is deposited, we submit the liquid to ebullution, and then add more nitric acid, until it no longer produces any nitrous acid vapours. To be assured of this, we cover the vessel from time to time with a porcelain capsule, under which the vapours condense, when we can easily detect the presence of the acid. By taking this care, we shall neither form the resin of the indigo, nor any artificial tannin. When cold, the solution affords hard and transparent yellow crystals; we decant the mother-waters, and wash the crystals. Upon boiling the crystals in water they dissolve, and there will form upon the surface of the liquid oleaginous drops, which are termed artificial tannin; these must be removed by means of filtering paper. On filtering the liquid, and suffering it to become cold, we shall now be able to separate from it a great quantity of brilliant and lamellated yellow crystals. Finally, and in order to obtain the carbo-azotic acid perfectly pure, we again dissolve these crystals in boiling water, saturate the solution with carbonate of potash, and suffer it to cool. We thus obtain the carbo-azotate of potash in crystals, which we must purify by washing and re-crystallizing them repeatedly. We mix the first mother-waters with cold water, and then obtain a brown precipitate, which must also be washed. This precipitate must finally be dissolved in boiling water, and be neutralized with carbonate of potash, in order to obtain a new quantity of the carbo-azotate of potash, which must likewise be dissolved in boiling water. We then add either the nitric, the hydrochloric, or the sulphuric acid; when cold, the carbo-azotic acid will crystallize in lamina, of a clear yellow colour, highly brilliant; and the greater part of which take the form of an equilateral triangle.

---

* From Ferussac's *Bulletin des Sciences Technologiques.*

Sometimes it will happen, that on treating indigo by the nitric acid, no crystals will form in the liquid. In this case we must evaporate it, and separate the acid from the residuum, in the manner above indicated. We may also pour off much liquid acid, which floats above the precipitate, and evaporate it to a proper degree. We then finally neutrallize it with potash, after having boiled it anew with nitric acid. Four parts of the best indigo will yield one part of this acid. We can also procure it from silk and aloes.

We obtain the carbo-azotate of lead with this new acid, and the carbonate of lead. It forms a yellow precipitate, difficultly soluble in water; and which strongly detonates when heated. (*Allg. Handlung's Zeitung*, Dec. 1828, No. 148.)

XXV.—*On an Odoriferous Lamp. By M.* J. B. BATTEA.

It is to professor Doebereiner that we are indebted for an highly interesting experiment; namely, the transformation of alcohol into vinegar, by the remarkable action of the sub-oxide of platina; it is sufficient only to remind our readers of his treatise on fermentation; and of a small work of his on this oxide, to enable them to perceive the great importance of this new technological application, which affords another synthetic proof to his summary of the interesting phenomena of fermentation. The vinegar-lamp, constructed for the purpose of demonstrating this experiment, has given birth to a new application of this apparatus in domestic economy; that is to say, *the odoriferous-lamp*, of which I have now the honour to give a description.

To fill the lamp (which has a glass bulb, funnel, or cup, formed in its stopple, containing the cotton wick, and the ball of the sub-oxide of platina placed upon it, and a projecting border or rim around it) we pour in *eau de Cologne*, and light the wick under the ball; we then blow out the flame, after it has heated the platina ball to redness, a few moments afterwards. The ball continues to preserve its red heat, notwithstanding the absence of the flame; and consumes by degrees the spirituous parts of the *eau de Cologne*, which diffuses a very agreeable odour.

When we would use this lamp to procure fire, it is sufficient to bring *amadou* (German fungus or tinder) into contact with the red-hot ball, but not to rub it too hard upon its surface. By the faint glimmer of this lamp we can easily read the hour of the night upon the dial of a watch; and it affords a gentle heat, by means of which we can keep tea, milk, water, &c. warm, when held in a small vessel, and supported upon a tripod above the ball.

To moderate the odour, and lessen the consumption of the *eau de Cologne*, we may occasionally cover the ball with a bell, having a hole in it; and in order to completely extinguish it, we have only to cover it with a bell not perforated.

The phenomena presented by the use of this lamp, afford philosophical observations of an elevated description; it is sufficient to state—

Firstly, that the flame disposes the *eau de Cologne* to evaporate.

Secondly, that the vapours of the alcohol continue to keep the platina ball at a red-heat: and lastly, that the alcoholic vapours are transformed into *aromatic vinegar*, by the action of the red-hot ball of platina. (*Journal de Pharmac.*, Aug. 1828, p. 409.)

Remarks by the EDITOR.

The novelty of this invention consists in the use of *eau de Cologne*, and in the substitution of the ball of sub-oxide of platina, for the helical coil of thin platina wire, placed around the cotton wick of a spirit-lamp.

LIST OF PATENTS FOR NEW INVENTIONS

Which have passed the Great Seal since July 2, 1829.

To Elijah Galloway, of King Street, in the Borough of Southwark, and County of Surrey, for certain improvements in Steam Engines, and in Machinery for propelling Vessels; which improvements are also applicable to other purposes. Dated July 2, 1829.—To be specified in six months.

To Jacob Perkins, of Fleet Street, in the City of London Engineer; for certain improvements in Machinery for propelling Steam Vessels. July 2, 1829.—In six months.

To Thomas Kilby, of Wakefield, in the County of York, Clerk; and Hugh Ford Bacon, of Leeds, in the same County, Gentleman; for a new and improved Gas-Lamp or Burner. Dated July 2, 1829.—In six months.

To Robert Crabtree, of Haleswoth, in the County of Suffolk, Gentleman; for a Machine or Apparatus for propelling Carriages, Vessels, and Locomotive Bodies. Dated July 4, 1829.—In six months.

To Margaret Knowles, of Lavender Hill, Battersea, in the County of Surrey, Spinster; for an improvement in Axletrees for, and a mode of applying the same to, carriages. Dated July 4, 1829.—In six months.

To William North, of Guildford Place, Kennington, in the County of Surrey, Surveyor; for an improved method of constructing and forming Ceilings and Partitions for dwelling houses, warehouses, workshops, or other Buildings; in order to render the same more secure against Fire. Dated July 4, 1829.—In six months.

To George King Sculthorpe, of Robert Street, Chelsea, in the County of Middlesex, Gentleman; for certain improvements on Axles or Axletree; and Coach and other springs. Dated July 4, 1829.—In six months.

To Joseph Clisild Daniell, of Limpley Stoke, in the Parish of Bradford, in the County of Wilts, Clothier; for certain improvements in Machinery applicable to dressing Woollen Cloth. Dated July 8, 1829.—In six months.

To William Ramsbottom, of Manchester, in the County of Lancaster, Journeyman Shape Maker; for certain improvements in Power Looms, for weaving Cloth. Dated July 8, 1829.—In six months.

To William Lees, of Birmingham, in the County of Warwick, who in consequence of a Communication made to him by his late Partner, William Tuft, of the same Place, deceased, is in possession of certain improvements in, or additions to, Harness and Saddlery; part or parts of which improvements or additions, are also applicable to other purposes. Dated July 8, 1829.—In six months.

To Moses Poole, of the Patent Office, Lincolns' Inn, in the County of Middlesex, Gentleman; who in consequence of a Communication made to him by a certain Foreigner residing abroad, is in possession of certain improvements in the Apparatus for raising or generating steam, and currents of Air; and for the application thereof to Locomotive Engines, and other purposes. Dated July 8, 1829.—In six months.

To Thomas Salmon, of Stokeferry, in the County of Norfolk, Malster; for an improved Malt-Kiln. Dated July 9, 1829.—In six months.

To James Chesterman, of Sheffield, in the County of York, Mechanic; for certain improvements on Machines or Apparatus for measuring land, and other purposes. Dated July 14, 1829.—In six months.

GILL'S

TECHNOLOGICAL & MICROSCOPIC REPOSITORY.

XXVI.—*On the Microscope.* *By* THOMAS CARPENTER, *Esq.* *With Remarks and Additions.* *By the* EDITOR.

WITH A PLATE.

DEAR SIR, *London, Aug.* 14, 1829.

ABOUT the middle of last month I was walking in a field of wheat, which had grown up into ear, but was yet in an immature state, the grains within not being fully formed; on looking over the stalks I observed numerous small brown spots on several of them, which, on examination, I found to be that species of fungi, described by me, in the third volume of your *Technological Repository*, page 140, but in an imperfect state. The minute seeds of these species of fungi, had found their way into the pores of the wheat stalks, had there taken root, and were making progress towards maturity. In the state I found them, you will perceive they differ from those I before sent you, which were fully ripe and bearing seeds. I have placed a few between two slips of glass for your inspection. You will observe these want those stems and bulbous heads, which the others, being in a perfect state, possessed: a few specimens of which I also send for you to compare them in both states.

From what I observed in this field, the proprietor will sustain much injury; as these parasitical plants appeared to be thickly diffused amongst the stalks or stems. The seeds which they produce are capable of doing injury to an extent almost incredible. In a speck of smut, almost invisible to the naked eye, is contained many hundred plants, each filled with numerous seeds, so exceedingly light, that when discharged from the plants, they float in the air. The stalk or stems of the wheat are full of pores or mouths, which open when the atmosphere is moist, in order to receive nourishment. The moisture descends into these mouths or pores, and with it some of these minute seeds, which immediately vegetate; and as the sap flows up from the roots to nourish the grain in the ear, it is stopped in its course by these parasitical plants for their support; and thus are the grains of the wheat deprived of that nourishment, which is necessary to bring them to maturity, for the food of man. In this case they dwindle or shrivel up, producing little or no flour. The smut or blight again ripens, and discharges innumerable seeds, which, as I before observed, float in the air, until carried down by the moisture into the pores. This process continues going on, until nearly a whole field of wheat is affected by it. And these minute seeds are carried by the wind over large districts of land. We may easily conceive, that was this permitted to increase, every stem or stalk of wheat, would, in process of time, become filled with this smut, and a general famine would be the consequence; and which was indeed apprehended some years back; and so serious was the evil considered, that our legislature thought proper to call a Privy Council, with the late Sir Joseph Banks at their head, in order to see if measures could not be adopted to prevent the dreaded calamity.

This is one, amongst those many minute causes, overlooked by us, in consequence of their apparent insignificance; but there are also thousands of others, and apparently of as little import, as this minute speck of smut; but which, nevertheless, if not held back by a restraining hand, would produce most fearful consequences.

On one of the ears of wheat I found a beautiful insect, *(gonypes tipuloides)* which having captured, I placed within a pill-box, in which it deposited several minute eggs, which were hatched in the course of a few days. This insect I send, together with the eggs; from which you will perceive, that one or two caterpillars were in the the act of leaving the shell; but not having sufficient strength, died in that situation. There was another insect on the same ear of wheat, a small species of gnat, which I also send. If you place these insects under your microscope, you will observe much to admire in their form, and also in the fine prismatic colours of their wings. On my return home, I met with a very rare species of cimex, which accompanies the above, for your inspection. You will find the head, eyes, antennæ, and the markings or characters on the thorax, exceedingly curious. I also send you a couple of curious water-beetles *(gyrinus natator)* which I found in a brook, near the wheat-field; there were numbers of these insects congregated together, but I found great difficulty in catching two of them, in consequence of the very rapid and whirling motion with which they swim on the surface of the water; and when closely pursued, they dive down, taking with them a bladder of air, attached to the end of their abdomen, to supply them during the time they remained under the water. They are curiously marked on the head and wing-cases, and at the end of the abdomen; and possess so lucid a surface, as to shine like a piece of looking-glass in the sun. Their eyes are compound ones; but instead of two clusters only, as in various other beetles, these insects have *four*; two of the clusters looking down in the water, and the other two upwards into the air! They are, no doubt, placed in these situations, to enable them to seize their prey, and also to escape from their enemies, by diving under the water. In the same water I met with a species of boat-fly, which had received an injury in one of its compound eyes; as a small piece of the cornea was broken, and projected above the surface. This piece was so exceedingly minute, as to be almost invisible to the naked eye; yet in this speck there are upwards of four dozen lenses, in each of which may be seen the image of any object. I have placed it between two slips of glass, that you may satisfy yourself, that the statement I make, is correct. I also met with a few polypes in the same brook, which I send in a small phial. These singular creatures appear to be the connecting link which unites the animal and vegetable kingdoms; inasmuch, as they possess properties common to both; for, as animals, they catch and devour their prey; and as plants, if cut and divided in any direction, each separate part becomes a perfect polype; as slips of certain plants, afford the same plants in a perfect form.

We are indebted to the repeated experiments made by, Trembley and Baker; and by which this fact in Natural History has been completely established. These animals adhere at one end, by suction, to water-plants, and other substances; the other end, which is the head, is surrounded by many arms or feelers, placed like rays around a centre—this centre is its mouth; and with these tender arms, which are capable of great extension, particularly in some species, it seizes minute worms, and various kinds of water insects, and brings them to its mouth, and often, even swallows bodies larger than itself, having a surprising property of extending its mouth wider, in proportion, than any other animal. After its food is digested in its stomach, it returns the remains of the animals it feeds on through its mouth again, having no other observable emunctory. This circumstance, strange as it may appear, I have often witnessed. In fact, one of these I now send, had attached to its feelers or suckers, three *monoculi* or water-fleas, one of which it carried to its mouth, and having swallowed it, in a very short space, succeeded in extracting the water-flea from its shell, which it apparently, with great ease, cast forth from its mouth; and shortly after the two remaining *monoculi* were devoured in the same manner.

After keeping one of these animals for some time, in a glass filled with water, I observed an appearance of small knobs or papillæ, formed on its sides; as these increased in length, little fibres were seen rising out of the circumference of their heads, as in the parent animal; which fibres they soon began to use for the purpose of procuring nourishment, &c. When these are arrived at a mature size, they send out other young ones on their sides in the same manner; so that the animal branches out into a numerous offspring, growing out of one common parent, and united together. Each of these provides nourishment, not only for itself, but for the whole society; an increase in the bulk of one polype by its feeding, tending to an increase in the rest. Thus a polype of the fresh water kind becomes like a plant, branched out, or composed of many bodies; each of which has this singular characteristic, that if one of them is cut in two in the middle, the separated part becomes a complete animal, and soon adhering to some fixed base, like the parent from whence it was separated, produces a circle of arms—a mouth is formed in the centre; it increases in bulk, emits a numerous progeny, and is, in every respect, as perfect an animal as that from which it was severed!

Much after the same manner, so far as hath hitherto been discovered, the marine polype, however different in respect to form, is nourished, increases, and may be propagated. Mr. Ellis, to whom we are indebted for much valuable information on the subject, having often found in his experiments, that small pieces cut off from the living parent, for the purpose of viewing the several parts more accurately, soon gave indications, that they contained not only the principles of life, but likewise the faculty of increasing and multiplying into a numerous issue. We are indebted to Mr. Ellis, for the discovery of what had been considered (previous to his laborious investigations) as marine plants and sea-weeds, to be living animals, and their habitations. I have often proved the fact. During a visit I paid at Hastings, I have frequently collected specimens of corallines; and by placing them in sea water, have observed numerous polypes protude themselves, and put forth their numerous arms or feelers in search of food. Some of those specimens I brought to town with me, in a bottle filled with sea-water, and they remained in a living state for several days after my return home. In the bottle I observed a very minute crab, about twice the size of a mite, very busy in running up and down the coralline, and appeared to stop at the various joints of which it is composed, for the purpose of catching and feeding on the polypes, as they protruded themselves. A few of these specimens I have placed on slips of card, which I now send; also a fine specimen of *sertularia,* between two slips of glass, on which may be seen the dead polypes lying within their cells; together with a small colony of other species, attached to a piece of fucus. The minuteness of some of these marine animals is truly astonishing. We find the habitations of them so exceedingly small, that a hundred of them does scarcely equal in size a grain of sand! On one of the cards I send, you will observe an apparent grain of sand; if you place this under your microscope, you will find it to be the habitations of numerous polypes. And on the other card you will observe a minute shell, in which numerous other species have established a colony. The construction of the habitations of the various species of marine polypes are as diversified, as the species which form them are numerous; and the rapidity with which the immense coral reefs are formed by them, is a matter of astonishment! I have a fine specimen of the sea-fan, formed by a particular species of these aninals. A small portion of this production I broke off, and having soaked it in warm water for some time, I macerated it, and found within it multitudes of polypes, a few of which I have placed upon a piece of card, which I send you, together with the remainder preserved in spirit of wine. Insignificant as these minute animals appear, yet they perform a most important part in the general economy of nature. The coral rocks, which grow from the bed of the ocean, were formerly thought to be of a vegetable nature;

but subsequent investigation has demonstrated, that the foundation of these immense masses is effected by certain species of polypes. A portion even of our own island is based on a foundation of coral, many of our transition rocks containing an immense number of fossil corals; and many islands between the tropics appear to rest entirely on masses of coral rocks. The order and regularity with which these vast accumulations of solid matter are constructed, by means, apparently so inadequate to the end, are no less astonishing, than the amazing number of such masses which are known to exist.

Thousands of islands in the Eastern Ocean owe their origin entirely to this source; and particularly those in the Indian Archipelago, and round New Holland, are produced by various tribes of these animals; especially by the cellepora, Isis, madrepora, millepora, and tubipora. The animals from these corals work with such rapidity, that enormous masses of them very speedily appear where there were scarcely any marks of such reefs before. And the navigation of the seas in which they abound, is rendered every day more difficult, by the continually increasing member of coral reefs, which will become the bases of future islands. These reefs have flat tops, and rise so perpendicularly from the bed of the sea, that the officers of vessels, within only two ships' length of them, have found no bottom at the depth of one hundred-and-fifty fathoms, or nine hundred feet! It is an interesting object of geological research, to trace the progress of these formations, by the minute but combined labours of millions of these marine zoophytes, which occupy the lowest rank in the animal kingdom; but which have been instrumental in giving to the earth its present form. The following interesting extract from Kotzebue's Voyages, (as cited in the Quarterly Review) gives the best description of the mode in which the islands, consisting of coral reefs, may have been progressively formed:—

"As soon as it (the ridge or reef) has reached such a height, that it remains almost dry at low-water, at the time of ebb; the polypes cease from building higher. Sea shells, fragments of corals, sea hedge-hog shells, and their broken-off prickles, are united by the burning sun, through the medium of the cementing calcareous sand, which has arisen from the pulverization of the above-mentioned shells, into one whole or solid stone; which, strengthened by the continual throwing up of new materials, gradually increases in thickness, till it becomes at last so high, that it is covered only during some seasons of the year by the high tides. The heat of the sun so penetrates the mass of stone, when it is dry, that it splits in many places, and breaks off in flakes. These flakes, so separated, are raised one upon another by the waves, at the time of high water. The always active surf, throws blocks of coral (frequently of a fathom in length, and three or four feet thick) and shells of marine animals, between, and upon the foundation stones; after this the calcareous sand lies undisturbed, and offers to the seeds and trees of plants, cast upon it by the waves, a soil, upon which they rapidly grow, to overshadow its dazzling white surface. Entire trunks of trees, which are carried by the rivers from other countries and islands, find here, at length, a resting place, after their long wanderings. With these come some small animals, such as lizards and insects, as the first inhabitants. Even before the trees form a wood, the real sea-birds nestle here; strayed land-birds take refuge in the bushes; and at a much later period, when the work has been long since completed, man also appears, builds his hut on the fruitful soil, formed by the corruption of the leaves of the trees; and calls himself the lord and proprietor of this new creation."

Captain Flinders, in his voyage to Terra Australis, also gives a lively and interesting description of a coral reef, on the southern coast of New South Wales. On this reef he landed, and the water being very clear round the edges, a new creation as it were, but imitative of the old, was presented to his view. Wheat-sheaves, mushrooms, stags' horns, negroes' heads, cabbage leaves, and a variety of other forms were glowing under water, with vivid tints of every shade between green, purple, brown, and white; equal in beauty, and excelling in grandeur, the most favourite parterre of the curious florist. These were different species of coral and fungus, growing, as it were, out of the solid rock; and each had its peculiar form and shade of colouring. But whilst contemplating the richness of the scene, the destruction with which it was pregnant could not be forgotten.

Different corals in a dead state, concreted into a solid mass, of a dull white colour, composed the stone of the reef. The negroes' heads were lumps which stood higher than the rest; and being generally dry, were blackened by the weather; but, even in these, the forms of different corals and some shells were distinguishable. The edges of the reef, but, particularly on the outside, where the sea broke, were the lightest parts; within these were pools and holes, containing live corals, sponges, sea eggs, and cucumbers; and many enormous cockles were scattered upon different parts of the reef. At low water these cockles seem most commonly to lie half open, but frequently close with much noise; and the water within the shell spouts up in a stream, three or four feet high. It is from this noise, and the spouting of the water, that they are discovered; for in other respects they are scarcely to be distinguished from the coral rock. His description of a coral island, which he afterwards visited on the same coast, is truly philosophical, and throws great light on these surprising productions of nature. "This little island, or rather the surrounding reef, which is three or four miles long, affords shelter from the south-east winds. It is scarcely more than a mile in circumference, but appears to be increasing both in elevation and extent. At no very distant period of time, it was one of those banks, produced by the washing up of sand and broken coral, of which most reefs afford instances; and those of Torres' Straight a great many. These banks are in different stages of progress: some, like this, are become islands, but not yet habitable; some are above high-water mark, but destitute of vegetation; whilst others are overflowed with every returning tide.

"It seems to me, that when the animalcules, which form the corals at the bottom of the ocean, cease to live, their structures adhere to each other, by virtue, either of the glutinous remains within, or of some property in salt water; and the interstices, being gradually filled up with sand and broken pieces of coral, washed by the sea, which also adhere, a mass of rock is at length formed. Future races of these animalcules erect their habitations upon the rising bank, and die in their turn, to increase, but principally to elevate this monument of their wonderful labours. The care taken to work perpendicularly in the early stages, would mark a surprising instinct in these diminutive creatures. Their wall of coral, which is, for the most part, in situations where the winds are constant, being arrived at the surface, affords great shelter, to leeward of which, their infant colonies may be safely sent forth; and to this, their instructive foresight, it seems to be owing, that the windward side of a reef exposed to the open sea, is generally, if not always, the highest part, and rises almost perpendicular, sometimes from the depth of two hundred, and perhaps, many more fathoms.

"To be constantly covered with water seems necessary to the existence of the animalcules; for they do not work, except in holes upon the reef, beyond low water mark; but the coral sand, and other remnants thrown up by the sea, adhere to the rock, and form a solid mass with it, as high as the common tides reach. That elevation surpassed, the future remnants, being rarely covered, lose their adhesive property; and remaining in a loose state, form what is usually called a key, upon the tops of the reef. The new bank is not long in being visited by sea birds; salt plants take root upon it, and a soil begins to be formed; a cocoa nut is thrown on shore; land birds visit it, and deposit the seed of shrubs and trees; every high tide, and still more, every gale, adds something to the bank; the form of an island is gradually assumed; and last of all, comes man to take possession.

"This island is well advanced in the above progressive state, having been many years, probably some ages, above the reach of the highest spring tides, or the wash of the surf in the heaviest gales. I distinguished however, in the rock which formed its basis, the sand, coral, and shells formerly thrown up, in a more or less perfect state, of cohesion; small pieces of wood, pumice stone, and other extraneous bodies, which chance had mixed with the calcareous substances when the cohesion began, were enclosed in the rock; and, in some cases, were still separable from it without much force. The upper part of the island is a mixture of the same substances in a loose state, with a little vegetable soil; and is covered with the *casuarina*, and a variety of other trees and shrubs, which give food to paroquets, pigeons, and some other birds; to whose ancestors, it is probable the island was originally indebted for this vegetation."—I have several specimens to shew you which will illustrate this subject and prove in how diversified a manner these animals form their dwellings. Some few years ago, I had sent me a quantity of fossil sand, which was found at a considerable debth under the surface of the earth, in the neighbourhood of Paris.—The sea had evidently, at some very remote period, covered that part of the globe; and on its retiring, had left a deposit of marine animals, which, after a lapse of many ages, had become in a fossil state.—In examining this sand, I discovered many curious remains of various species of zoophytes;—Among these are some ovalites, with minute pores spread over their surface and openings at each end which are perhaps accidental, or may be the mouth or vent of the animal, the same as in the echinus.—These I preserved, and submitted to the inspection of my friend, the late James Parkinson Esq. author of "Fossil Organic Remains" who informed me that several of the specimens I then produced were not known to exist at this day; the species having become extinct. When I have the pleasure of seeing you at my house, I will shew you those specimens, which I selected from among the sand, and which sand you will perceive is composed of minute particles of the various marine animals, which had been left on the receding of the sea. It is very evident, that the sea, at one time or other, has covered the whole of our globe; for, in digging we find in various parts of it, deposits of marine animals. In various parts of England, they are to be met with under the surface of the earth in abundance.—Near Reading, there are large beds of oysters, which clearly prove that the sea at one time must have covered that part.—The late William Phillips, in his "Outlines of Geology" second edition, in the third lecture, describes this globe of ours, as having suffered many and very great convulsions at various and remote periods. He observes, that in digging under the earths' surface, near Paris; at a certain depth, you will perceive an alluvial deposit; composed of sand, marl, clay, and rolled stones, caused by the rush of waters, tearing up and washing away the parts of rocks; and, on their returning left the fresh water deposit, and which encloses the remains of trees, and various large land animals. In digging deeper, you come to another deposit, or formation, which extends ninety miles in length, and contains fresh water and land shells, in great abundance.—This formation, or deposit, he considers must have preceded the other by many ages. In digging deeper still, you arrive at another deposit, or formation, left by a flood, which took place many ages before the last, and which is evidently formed from the sea flowing over that part; for in this deposit is found numerous marine shells, various species of zoophytes, and two beds of oyster shells, lying in the same regular manner, as in the ocean.—(From this deposit I received the fossil sand, before mentioned.)—Mr. Phillips proceeds to state, that at a remote period before the last deposit, another flood had taken place on the surface of the globe; for, in digging still deeper, you arrive at another fresh water formation, which contains petrified wood of the palm kind, the remains of fishes and shells, and also the remains of many extinct birds, quadrupeds, amphibious animals, fishes, and shells; all of which are of land or fresh water species—again, in digging deeper still, you come to another deposit, which has evidently been occasioned by the sea flowing over this part; and, on its retiring this marine formation took place, which must have been many ages before the preceding.—At a great depth below this last, is found plastic clay, lying in a bed of chalk.—For a more copious and interesting account, of the wonderful changes the surface of the earth has undergone, I beg to refer you to the above work, and to Curvier, on the Revolutions of the Globe; also to Parkinson's introduction to the study of Fossil Organic Remains, page 333. During the time I was at Hastings, a violent storm, which had taken place during the night, had thrown on the beach large masses of mineralized wood; these pieces, no doubt, were part of numerous trees, which are at present covered by the sea, and undergoing great changes. I send you a small portion from one of the masses I found, in which you will perceive the interstices are filled with quartz, which appears in small crystals. This piece, if placed under the microscope, produces a most splendid effect, resembling grottos of diamonds.—I also send you a fine specimen of crystallized gold, this I received from Mr. John Cuthbert, who, it appears, having some gold in solution, observed a fine film at the bottom of the vessel which contained it: and, on examining this apparent film, he found it composed of the gold, which had fallen down in exceedingly minute particles, and thus formed a layer of crystals.—With this you will also receive some crystals of gold, of a larger size found under the earth's surface. The gold, by some chemical agency, which is continually going on, beneath this globe of ours;—was held in solution, and it would appear, that some other cause having acted on this, had set the gold at liberty, and which process formed it into the crystalized state, in which you now perceive it, resembling, in appearance, the crystalization of certain salts. You will observe also portions of the matrix or bed, in which the gold lay embedded. Before I conclude this letter, I would recommend you to pay our friend, Mr. William Tulley, a visit; who will shew you a very interesting experiment made by him on the eels in paste. This consists in placing a few of the eels in a little clear water for a day or two, during which time they will so completely clear their intestines, that they become quite transparent. In this state, you will perceive numerous young ones, lying within the body of the parent; and, under his microscope, the parent eels present the appearance of long bags filled with living eels. This experiment, if tried by Mr. Philip Carpenter, of Regent Street, under his solar microscope, would present a grand and highly interesting spectacle to his visitors.

I am, Dear Sir,
Your obliged friend,
To THOMAS GILL, *Esq.* THOMAS CARPENTER.

Remarks and Additions. By the EDITOR.

In plate III., fig. 1 is the head, eyes, and antennæ of the cimex, mentioned by Mr. T. Carpenter. Fig. 2 is a top view, and fig. 3 a side view of the head and part of the thorax of the small water-beetle, also mentioned in his letter; and in the former of which its pair of upper eyes are seen; and in fig. 3 one of the upper, and one of the lower eyes. Fig. 4 is part of the cornea of the compound eye of a boat fly, also mentioned by Mr. T. Carpenter.

Fig. 5 part of the grain of sand, pierced full of holes by marine polypes, as described by Mr. T. Carpenter. Fig. 6 a marine polype. Fig. 7 part of a nest of polypes, also mentioned by him. Fig. 8 a piece of coralline, in the Editor's collection of opaque microscopic objects. Fig. 9 one of the ovalites, mentioned by Mr. T. Carpenter, as being found by him in the sand, from the neighbourhood of Paris. The opening in its upper part, and the minute pores all over its surface, are distinctly seen. The specimens of crystallized gold, mentioned in Mr. T. Carpenter's letter, not being equal to others in the Editor's collection; he has preferred to have drawings made from them. Fig. 10 is a magnified representation of part of a leaf of native gold, with very beautiful equilateral triangular crystals, terminating in three triangular facets all over it. And fig. 11 represents some solid crystals of gold, of other forms, which adhere to the leaf. Fig 12 is a flat and thin hexagonal crystal of gold; and fig. 13 another, but which has also three raised ridges, extending from its centre to its sides.

These crystals are found in a deposit of gold, which has formed itself at the bottom of a phial, containing an etherial solution of gold, after standing at rest, upwards of twenty years. They are imbedded in a granular concretion of gold, and possess a high degree of polish, which admirably contrasts with the deadened, or matted appearance of the rest of the mass. Fig. 14 is a magnified cross-section of a porcupine's quill; and fig. 15 a longitunal slice of it, shewing its curious structure. And fig. 16 represents a beautiful larva, lately found by the Editor, in the water had drained from a pot containing a fine plant of the begonia. This larva has a round flat head, and is all over studded with minute red spots, like so many rubies! It is perfectly transparent, and the peristaltic motion of its intestines can be clearly seen. It is of the size it appeared under a single lens, the twentieth of an inch in focus.

(*To be continued.*)

XXVII.—*On the Manufacture of French Articles of Perfumery.*

(*Concluded from page* 124.)

LIQUID ALMOND PASTES.

THESE pastes are esteemed, on account of the advantage they possess, of being used without water. Such are those of the rose, orange, vanille, and *bouquet.*

The honey paste is, however, justly preferred; and is prepared in the following manner:—

6	pounds of honey
6	pounds of paste of bitter almonds
12	pounds of the oil of ditto
26	yolks of eggs.

The honey must be boiled separately, and strained; we then add the six pounds of almond paste, and knead them together; and finish the operation, by adding gradually and alternately, the quantities of yolks of eggs, and oil of bitter almonds indicated.

ROUGE.

We put into linen bags *carthamus* or *safranum,* and place them under a thread of running water, taking care to beat them strongly all the while; by this means we are enabled to separate the red, from the yellow colouring matter of the carthamus; we continue this treatment until the water ceases to be any longer coloured. The tint of the material will then have completely changed its appearance, and have become of a fine red; we then treat it in the cold, with a solution of potash, at four degrees, for twelve hours, and decant it. We then take the nearly exhausted residuum, and treat it anew in the same manner, but by a solution of potash marking only two degrees. All the liquids being then united, we pour in by degrees, the juice of citrons, to a perfect saturation: the red colouring matter will then gradually precipitate; containing, however, some portion of the yellow; we completely free it from this, by plunging it into a piece of cotton cloth, which completely separates the two colouring matters; but on treating it anew with potash, the red colouring matter will only dissolve, and the yellow remain adhering to the cloth. It is then sufficient to again saturate the alcaline liquor with citron juice, and the red colour of the carthamus precipitates; this is afterwards mixed with prepared talc, and sold under the name of *fard.*

WHITE.

The fard white is procured by dissolving bismuth, previously freed from arsenic, in nitric acid, diluted with one-third its weight of water; it is better that the nitric acid should be perfectly pure, and the solution limpid. Often, however, this appearance will not present itself, as there is generally formed an arseniate of bismuth but little soluble; in this case we must decant it, and pour into the solution a great quantity of water, and until the precipitate forms more abundantly. This precipitate must be frequently washed to free it from an excess of nitric acid; this done, and if it has been well prepared, it will be of a brilliant whiteness, and in small *micaceous* scales.

ROSE, ORANGE-FLOWER, AND VANILLE PASTILS.

Rose Pastils.

12	ounces of gum arabic
12	ounces of olibanum, in tears
12	ounces of storax, ditto
8	ounces of nitre
16	ounces of powder of white roses
3	pounds fourteen ounces of charcoal powder
1	ounce of essence of roses.

Orange-flower Pastils.

12	ounces of gum galbanum
12	ounces of olibanum, in tears

12 ounces of storax, in tears
8 ounces of nitre
3 pounds fourteen ounces of charcoal powder
1 ounce of superfine *neroli.*

Vanille Pastils.

12 ounces of gum galbanum
12 ounces of olibanum, in tears
12 ounces of storax, ditto
8 ounces of nitre
8 ounces of cloves
16 ounces of powder of pure vanille
3 pounds fourteen ounces of charcoal powder
4 *gros* of essence of cloves
8 ounces of essence of vanille, first infusion.

We must thicken each of these mixtures with two ounces of gum tragacanth, dissolved in two pints of rose-water. It is necessary to add, that all the materials must be reduced into the state of an impalpable powder.

The making of pastils naturally leads us to describe *le parfum des rois.* Some drops of this liquor being burnt in an apartment diffuses a most agreeable odour; it may be made either by infusion or distillation:

8 *litres* of spirit, at three-sixths
1 pound of gum benzoin
1 pound of storax
8 ounces of aloes-wood
1 *litre* of spirit of roses, first infusion
1 *litre* of spirit of orange-flowers, first infusion
8 ounces of essence of amber, ditto
8 ounces of essence of musk, ditto
1 pound of essence of vanille, ditto.

Our ladies also use the *odoriferous casolettes,* which they constantly carry about them to balls and public spectacles. The paste which forms them is thus prepared:

8 pounds of black amber
4 pounds of rose-powder

2 ounces of gum benzoin
1 ounce of essence of roses
1 ounce of gum tragacanth
Some drops of oil of sandal-wood.

We must first pulverize all these substances, add the liquids, and form them into a paste with the gum tragacanth.

ESSENCES.

We shall shall now enumerate the essences most generally employed in perfumery:

- Essence of roses
- Essence of neroli
- Essence of cloves
- Essence of *petit-grain*
- Essence of *bergamot*
- Essence of zest of citrons
- Essence of distilled citrons
- Essence of *serpolet*
- Essence of rosemary
- Essence of myrrh
- Essence of *bizarrade*
- Essence of *cédrat*
- Essence of Portugal
- Essence of amber
- Essence of musk
- Essence of *vanille*
- Essense of lavender
- Essence of cinnamon
- Essence of *limette*
- Essence of English mint.

Unfortunately, we seldom find these essences in commerce unadulterated. We may mention, for instance, those of *bergamot* and citron, in which we constantly find a greater or lesser quantity of the essence of Portugal; sometimes we find them still more grossly falsified, by adding variable quantities of oil or spirit. We have no certain means of detecting the falsification; nor have the experiments made with this view hitherto been sufficiently satisfactory.

ESSENCES MADE BY INFUSION.

Essence of Musk.

5 ounces of musk cut into small morsels
1 ounce of civet
4 *litres* of spirit of *ambrette*.

We put the whole into a matras, and expose it to the heat of the sun for the space of two months, choosing the hottest months in preference. But if the preparation be made in winter we must employ a water-bath.

Essence of Vanille.

3 pounds of vanille, in branches, of the first quality; these must be cut into small morsels;
4 *litres* of spirit of *ambrette*
2 *gros* of cloves
4 *gros* of cinnamon
Half a *gros* of musk.

Pursue the same method as for the essence of musk.

Essence of Amber.

4 ounces of amber-gris
2 ounces of musk
4 pints of spirit of *ambrette.*

To be treated also in like manner.

Essence of Rhodes.

This essence has been used for these twelve or fifteen years past, but much more commonly lately; it is indeed imperfectly replaced by the essence of roses of Constantinople and France; the latter being now worth 100 francs the ounce; whereas, formerly, we could hardly obtain forty-five francs for that of the first quality. Many perfumers also employ it to mix with the essence of roses, as it communicates to the latter a strength which it does not ordinarily possess. It is, particularly, the scientific perfumers, who perceive this advantage.

Esprit d' Ambrette.

They take twenty-five pounds of *ambrette,* which they distil with twenty-five *litres* of spirit of three-sixths; to which they also add six pints of water, and draw off twenty-five *litres.* The spirit of *ambrette* employed in the preparation of the essence of vanille is thus made.

Perfumed Bags.

These are formed of cotton cloth, filled with odoriferous powders, and afterwards covered with taffety, the colour of which varies according to the taste of the wearer.

At Montpelier the powders are replaced by the odoriferous plants; such as thyme, wild-thyme, and rosemary.

Powder of Carnations.

3 pounds of Provence rose-leaves
3 pounds of iris leaves
6 ounces of cloves
1 pound, four ounces, of *bergamot* rind
1 pound, eight ounces, of grains of *ambrette*
6 ounces of cinnamon
6 ounces of long cyprus
1 pound ten ounces of pale rose-leaves
8 ounces of dry *rassies*
8 ounces of orange-flowers
8 ounces of the leaves of carnations.

We must mix the whole together, and powder and sift it as fine as possible.

Powder of Musk-roses.

6 pounds of pale rose-leaves
1 pound of cyprus powder
1 *gros* of essence of roses.

Follow the same process as for the preceding powder; but observe, that the essence of roses is not to be added, until the powder has been made and sifted.

POMMADE GLOVES.

Every one knows that these gloves are used for softening and refreshing the skin. They are prepared with a *pommade à fleurs*, to which is added a little white wax. As the odour of the rose is the sweetest, this is generally employed in preference.

VINEGARS FOR THE TOILETTE.

These are always made by distillation, and of whatever odour may be required to be communicated to them.

Rose Vinegar.

60 pints of natural vinegar, of the first quality
4 pounds of dried pale rose-leaves.
Distil the whole and draw off thirty pints.

Thyme Vinegar.

60 pints of natural vinegar
4 pounds of thyme flowers.
Distil, and also draw off thirty pints.

To give a more agreeable perfume to this vinegar, thirty pints of rose vinegar may be added to it.

We may also follow the same process to form the following vinegars: viz.

Rosemary
Margerom
Wormwood
Angelica
Savory
Balm
Cinnamon
Cloves
Laurel
Wild thyme
Lavender
Citron
Orange-flower
Des sultanes.

We can also prepare vinegars for the toilette of other odours; such as those of vanille, carnation, jasmine, tuberose, and others. These last, for example, are prepared by distillation, by adding extracts of strong odours.

Amongst the various kinds of vinegars employed to expel bad air, we shall indicate that, which, has been long known, under the name of *vinegar of the four thieves.*

200 pints of vinegar of the best quality
One and a half pounds of dried rosemary
One and a half pounds of dried sage
One and a half pounds of dried mint
One and a half pounds of dried rue

One and a half pounds of lavender flowers
One and a half pounds of *calamus*
One and a half pounds of cinnamon
One and a half pounds of garlic
12 pounds of the greater wormwood
12 pounds of the lesser ditto.

We distil off these 200 pints of vinegar, from the materials, not bruised; and then pour it upon another equal quantity of the materials, completely pulverized. After suffering them to infuse the necessary time for the impregnating of the vinegar, we distil off twenty-five pints, in which we dissolve, in the cold, one pound of camphor, and then add to the solution twenty-five cloves. This last material is intended to communicate the desired colour to it. The whole is then suffered to remain at rest till the process is finished. The residuum of this operation will serve to prepare a new quantity of vinegar, equal to the first.

There are also many vinegars possessed of other properties—such as vinegar for the stings of gnats; Seville vinegar, for moistening tobacco; vinegar of squills, for the voice; dentrific vinegar, and Roman vinegar, for the teeth; vinegar of Flora, to abate the heat of the skin; *vinaigre spectique,* for wrinkles; and lastly, dissolvent vinegar, for corns on the feet.

VINEGAR DE ROUGE.

Many persons prefer this to the *rouge* in pots, or in powder, on account of the facility in using it, which it affords.

Composition of Vinaigre de Rouge.

8 ounces of carmine, of the best quality
4 ounces of cochineal, in powder.

These ingredients are to be boiled in twelve pints of rose-water, and eight pints of spirit of roses; and their colour developed with two ounces of cream-of-tartar, and one ounce of alum. The liquid of this first operation constitutes the first shade; the second shade is obtained with the residuum, by again adding the same quantities of rose-water, and spirit of roses to it.

The residuum of the second shade again serves to make a third, by adding similar quantities of rose-water, and spirit of roses to it.

We regret that it is not in our power to afford longer details of an art, which, in many respects, possesses an interest sufficiently important; nevertheless, what we have given, will be sufficient to enable any one to conceive the progress of every particular of this manufacture. And we may remark, that the art is yet but in its infancy. In fact, it is every day profiting, from the discoveries which the Physical Sciences add to the processes of manufactures.

EDWARD LANGIER.

XXVIII.—*On the Great Advantages of Steam Navigation; and on the Claims of Mr. Henry Bell, of Glasgow, to being the First Practical Introducer of it* *.

A PUBLIC meeting of the promoters of Mr. Bell's claims on the national gratitude, was held at Liverpool, on the 15th of July last; J. Gladstone, Esq. M. P. being called to the chair.

The Chairman briefly explained the objects of the Meeting. He said that the public were greatly indebted to the services of the individual, who had first caused steam-vessels to effect the purposes for which they were intended; and it was well known, that the individual who had done this, was Mr. Bell. In completing the experiment, and perfecting the invention, Mr. Bell had, however, sacrificed his property; and now, in a state of comparative destitution, was compelled to look to a benevolent public for assistance and support. He was now in the decline of life, and from his infirmities, incapable of exertion for his own benefit; all, therefore, he had to look to, was the support of the public on which he had so many claims. Resolutions, calculated to promote the object in view, would be submitted to the meeting, by gentlemen well acquainted with all the details of the subject. On the suggestion of Mr. Egerton Smith, the Chairman then introduced Mr. Morris to the meeting, as the active and authorized agent of Mr. Bell.

---

* From the *Liverpool Mercury.*

Mr. Morris, in the name of his friend Bell, tendered his grateful acknowledgments to the gentlemen composing the meeting, for their interference in his behalf. He felt strongly on account of Mr. Bell. It was now four years since he (Mr. Morris) had made a resolution, that the cause of Henry Bell, should never sleep, until either the Nation or the Government had done their duty; and he had never swerved from that resolution. It was his firm conviction, *that Mr. Bell, in the practical introduction of steam-navigation, had conferred an obligation of universal importance on his conntry and the world!* He had just arrived at this conviction, on his passage from Glasgow to Liverpool, in the Henry Bell (steamer,) and his return in the James Watt. On his return to Glasgow, the editors of the *Chronicle* and *Free Press* newspapers zealously took up the cause, in the insertion of a series of letters written by him (Mr. Morris); and in consequence of their exertions, thirty-three petitions from Scotland, and one from Liverpool, in behalf of the claims of Mr. Bell, were presented to Government. The appeal of Mr. Bell, was supported by several Members of Parliament, amongst whom was their respected Chairman, Mr. Gladstone. They were not successful, but Mr. Canning caused a grant of £200 to be made to Mr. Bell, as to a meritorious individual. Mr. Bell was advised by his Glasgow friends not to draw this sum; but to wait, and see whether Government would make it an annuity of £200. In September last, a letter from him (Mr. Morris) appeared in the *Liver-*

pool Mercury; and shortly afterwards, Mr. Gladstone, called upon the editor, to propose the raising of a subscription in Liverpool; but not succeeding in this, Mr. Gladstone wrote to Mr. Bell's friends in Glasgow, inclosing £5, as his mite. It was then resolved to urge Mr. Bell's claims strenuously in Glasgow, Edinburgh, Liverpool, and Manchester; and Mr. Cleland, the Lord Provost of Glasgow, James Ewing, Esq. and Mr. M'Gavin, gave him (Mr. Morris) liberty to publish their names, as his credentials, in advocating the claims of Mr. Bell, In three months £500 was raised in Glasgow, in addition to an annuity granted by the River Trust of Glasgow, in consideration of the services of a worthy individual, involved in difficulties, not brought on by extravagance, or his own fault. He was the friend, but not the flatterer of Mr. Bell; and he admitted that his difficulties were partly to be attributed to his fondness for scheming; but surely the nation had reaped the advantage of that disposition! The annuity granted by the River Trust was, formerly £50; it was now £100 per annum. He thought that the City of Glasgow had done its duty. In March last he went up to London; but the minds of all classes were then so much engrossed by the Catholic question, that the claims of Mr. Bell, could not be listened to. The grant of £200, was however, confirmed; and perhaps something more might yet be expected from the same quarter. Several liberal subscriptions were at the same time received from Archibald Campbell, Esq., M. P., Robert Downie, Esq., M. P., Joseph Hume, Esq., M. P., (who, in other respects, evinced a deep interest in the success of the subscription;) and from other Honourable Members; also from two Noble Peers (Melville and Buccleugh;) and several highly respectable engineers. Mr. Morris then read a letter of introduction in his favour to Mr. Knowles, a gentleman connected with the Navy Board, written by Mr. Brunel, the celebrated engineer; in which the writer strongly advocated the claims of Mr. Bell, *and gave him all the merit, of* *being the first practical introducer of steam navigation.* Mr. Knowles, also acknowledged the claims of Mr. Bell, and recommended that the Navy Board, should be addressed in his behalf. Such an application had been made, and he hoped it would be productive of some good results. He then stated, that it been agreed by the friends of Mr. Bell, that the funds raised in Glasgow, should be appropriated to the purchase of a joint annuity for Mr. and Mrs. Bell; and that what was raised elsewhere, should be given to Mr. Bell, for the redemption of some property at Helensburgh, which had been involved on account of the experiments of Mr. Bell. Mr. Morris concluded, by reading some extracts from the fifth Report of the Select Committee of the House of Commons on steam-boats, from June, 1822; which, after narrating the various steam-boat experiments of Mr. Hull, in 1736; the Duke of Bridgewater, Mr. Miller, of Dalswinton, the Marquis de Jouffroy, in 1781; Lord Stanhope, in 1795; and Mr. Symington, on the Forth and Clyde Canals, in 1801, says, "still no practical uses resulted from any of these attempts. It was not till the year 1807, when the Americans began to use steam-boats on their rivers, that *their safety and utility were first proved. But the whole merit of constructing these boats, is due to natives of Great Britain! Mr. Henry Bell, of Glasgow, gave the first model of them to the late Mr. Fulton, and went over to America with him, to assist him in establishing them.* Mr. Bell, continued to turn his talents to the improving of steam apparatus, and its application in various manufactures about Glasgow; and in 1811 constructed *the Comet (the first practical steam-boat in Europe)* to navigate the Clyde, from Glasgow, to Hellensburgh, Greenock, Inverness, &c.

Mr. Alston rose to move the first resolution:—" That it is the opinion of this Meeting, that Mr. Bell is justly entitled to the gratitude of his fellow-countrymen, by the invaluable service which he has rendered, not only to Great Britain, but to the civilized world, by the practical introduction of navigation by steam, in the intercourse of nations. His claim to which, is amply borne out, by the fifth Report of the Select Committee of the House of Commons, on steam-boats, and by other unimpeachable documents." He said he had been amongst the number of those who enjoyed the pleasure of seeing a steam-boat, for the first time, navigating the waters of a British river. He well remembered the astonishment and delight of those, who witnessed the first experiment on the Clyde. Nothing could excite greater wonder amongst the seamen, than seeing a vessel propelled against what they had, till then, deemed insuperable difficulties—an adverse wind and tide. In consequence of that experiment, there were now on the Clyde upwards of fifty steam-boats, all in full employment; and there was fully the same number from the port of Liverpool, of a larger size, and carrying on a more important commerce! When he considered how much the Great Dock Estate had benefitted by the introduction of steam navigation; what advantages had been derived to the mercantile interest, from *increased expedition and certainty, in getting vessels in and out of port; with the acceleration of the whole commerce of the world, consequent on this discovery,* he could not suppose that the Dock Trustees, mercantile men, or indeed the members of any class, interested in the prosperity of the town, and the extension of trade and commerce, would be forgetful of the claims of the man, who was the first to apply steam successfully to the purposes of navigation! For his own part, he was fully convinced, that *steam navigation was only yet in its infancy; and that if means could only be devised, by which the necessary force, or the power, could be condensed; steam-vessels would, probably, supercede all other modes of navigation!* What then was due to the man who first brought the principle successfully into action?—He concluded by moving the first resolution.

Mr. Egerton Smith, seconded the resolution. He said the first thing to be decided was, whether the gratitude of the public was due to the practical introducer of steam navigation; and then, whether Mr. Bell, was the proper object of that gratitude. Both points must be proved to the conviction of every man, by the Grant made by Government in behalf of Mr. Bell. He was of opinion, however, that the Grant was very insufficient, when the nature of the services rendered, were taken into consideration. The Grant of Government was only ten times the amount of the subscription of their liberal and respectable townsman, Mr. Fawcett, for the same purpose. One objection against the steam-engine, advanced by some individuals, was the misery entailed by it, on those whose labour came in competition with it; but whether this objection was well founded or not, it was by no means applicable to steam navigation. *By means of steam, voyages from one town to another, were rendered pleasant, safe, expeditious, and economical;* and every man in the country was indebted to the individual who had put him in possession of such advantages. *One very beneficial use of steam, was its application in towing vessels in and out of harbour.* Such was the prejudice against this application of steam, fourteen or fifteen years ago, that when he wrote several letters, recommending its adoption, he was laughed at for the idea; though he only advised the adoption of a scheme which had been found perfectly applicable in America. *Now, there was scarcely an hour passed, in which vessels were not towed in or out of the river!* He then mentioned a fact, showing *the immense importance of steam-towing* to commercial men:—Some years ago, before its adoption, a fleet of vessels, perhaps to the number of 100, set sail together from this port, on their outward voyage. The wind was then fair, but before they had passed the Black Rock, it suddenly chopped about to the north-west; and the whole fleet, with the exception of one which got round, were obliged to return. The vessel that got round, however, pursued her voyage to Barbadoes; and on her return to Liverpool, actually found the vessels she had left behind her, still wind-bound in port! Here was a detention of three months, and all the expences attending it, together with the loss of the market: and it was evident, from this simple application of steam, many thousands of pounds annually might be saved to the mercantile interests. Another objection of some individuals was, that as Mr. Bell, was a native of Scotland, he ought to be supported by Scotchmen. Now, when it was proposed to reward Dr. Jenner, for having introduced vaccination, no enquiries were made as to his country. Mr. Bell, had also conferred a great national service, and it was very extraordinary that he should be referred to Scotland only, for his reward! He had made some enquiries as to the effects produced by the employment of steamers on the river Mersey, with respect to sailing vessels and boatmen; and the result of his enquiries was, that so far from steam interfering with these, there were now more seamen employed between Liverpool and Dublin, and more ferryboats and boatmen on the river, than there ever were before. It was therefore evident, that steam-engines applied to navigation, had not the effects attributed to other species of machinery. He cordially seconded the resolution.

The Chairman said that he perfectly remembered the circumstance mentioned by Mr. Smith. The vessel performed the voyage to Barbadoes and back, and on her return found the others still lying wind-bound in port.

Mr. W. W. Currie said, that he approved so entirely of the objects of the Meeting, and thought that Mr. Bell, had such strong claims on the public gratitude, that, he felt very great pleasure in proposing the next resolution. It had been very ably stated by the gentlemen who had already spoken, that Liverpool was particularly called upon to come forward on this occasion. In addition, to what may be said on the general principle, great credit was due to the individual who had introduced steam navigation, were it only for the *increased safety* with which it was attended. When it was first introduced, a strong prejudice existed among naval officers, who thought themselves degraded, if asked to take the command of a steam-boat. But, when steam-packets were successfully established on the Holyhead station, for the conveyance of the mail to Dublin, and naval officers were appointed to command them, the experience of one or two winters was sufficient to convince them of their efficacy and advantage. There could be no doubt, that in a gale of wind, or on a lee-shore, the power of the paddles would break the sea, and greatly diminish the danger to be apprehended. He concluded, by reading the Second Resolution, as follows :—"That whilst the Empire at large is reaping immense benefit from the system of Steam navigation, there is no town in the Kingdom probably, whose interest is more essentially promoted than Liverpool. And this Meeting, therefore, confidently call upon their fellow-townsmen, as well as the inhabitants of other sea-ports, and other manufacturing towns, for their support, and zealous co-operation, in forwarding the objects, for which the Meeting is this day assembled."

Mr. John Smith, in seconding the resolution, said he could not but approve of the objects of the Meeting, when he witnessed the great improvements in the town and neighbourhood; and particularly at the opposite side of the river; which were, in a great measure, to be attributed to steam navigation. This disposition was strengthened by the knowledge of the important results of steam navigation, with regard to commerce, in America, and other parts of the world. On the first mention of steam-boats, it was anticipated that they would do mischief, and that they would be productive of injurious effects to seamen; but there were now more seamen employed, than ever there had been previous to their introduction. Ruinous consequences had been predicted as likely to arise; and the ruin was very visible in the increased population, towering spire, and spreading streets in Berkenhead! He thought that steam-boats might be well compared to floating bridges; they, undoubtedly, had the effect of bringing towns and countries nearer to each other. They could not shut their eyes to the fact, that Mr. Bell, was deserving of his country's gratitude for what he had done; and he trusted that sufficient would be done for him, to solace him in his old age and infirmity. A grant of money had been made to Dr. Jenner, for the introduction of vaccination; Mr. M'Adam had also been twice munificently rewarded for what, after all, was but the revival of an old method of making roads. At all events, Mr. M'Adam, had not conferred a greater benefit on the roads, than Mr. Bell, had on the rivers; and Mr. Bell was as much entitled to a National Reward, as either of the individuals he had named.

Mr. Alston, in alluding to the objection made to Mr. Bell's claims in England, on account of his country, said, that Mr. Bell was not a Scotchman, nor an Englishman, nor confined to any country, but was a *Citizen of the World, in consequence of the important benefits which he had conferred upon it!* He might as well state, that the River Trust, of Glasgow, which had behaved so handsomely towards Mr. Bell, had an annual income of £18,000 only; out of which they, nevertheless, had allowed Mr. Bell £100 a year; besides this, a subscription of £600 was raised in Glasgow. Now the annual income of the Dock Trustees of Liverpool, was £150,000; and surely a small matter out of their funds might be very well afforded.

The Chairman then recommended the gentlemen present to give every assistance and support to Mr. Morris; and spoke of the strong claims of Mr. Bell, on the owners of steam-boats; on engineers, furnishing the necessary apparatus; and on merchants and other individuals.

XXIX. — *On some of the most important advantages to be derived from improving our Settlement at the Cape of Good Hope, and the Mauritius, by* SIR JOHN SINCLAIR, *Bart.*

133, George Street, Edinburgh, April 7, 1829.

I HAVE long been strongly impressed with the idea, that the Cape of Good Hope might be rendered as important a colony as any that Great Britain *has ever possessed.* Its admirable situation, fronting America, and half way between Asia and Europe, the excellence of its soil and climate, would enable us to raise several articles we particularly require from better climates than our own, as wine, silk, hemp, tobacco, &c. and by the production of which, adequate to our demands, the Cape would become a possession almost invaluable; while, as only a small portion of its inhabitants are of foreign extraction, it might soon be rendered a colony purely British.

I have long wished to ascertain the causes of its remaining in so unproductive a state, and the means of rendering it a great colony, but have never been able to collect the materials necessary to draw up a plan for that purpose, until lately, that I had an opportunity of discussing the subject with a most intelligent traveller, Mr. Macadam, a surgeon on the marine establishment, who had resided there for some time, principally with a view to botanical researches, but who had likewise fortunately directed his attention to other important objects of inquiry.

The following information is almost exclusively derived from his communications.

It is a most fortunate circumstance also, that Mr. Macadam had likewise visited the Mauritius, where there is a field for improvement, by extending the cultivation of cotton, of infinite consequence to this country; for we might thus be furnished with that production, not only of a superior quality, but rendered independent of other countries for an article, that has now become the most important of all our manufactures.

SECT. 1.—*Of the geographical circumstances of the Cape of Good Hope.*

The climate of the British dominions in the south of Africa is one of the finest in the world. The average height of the barometer is above thirty inches, and the average summer heat at noon is about 78°. It resembles the climate of Italy, but is rather warmer and dryer. It is so dry, that draining is little required for the ground,—on the contrary, it is necessary to retain moisture as much as possible, and even irrigation is desirable, more especially for the grasses. The mountains abound in springs, but the supply of water is scanty and precarious, from the want of energy and skill in procuring that essential article. Such a scarcity frequently arises, that the cattle perish from thirst, and the people themselves are in danger of a similar fate.

SECT. 2.—*Agricultural state of the Cape.*

The soil of a great portion of this very extensive territory is exceedingly fertile, and generally rich. Here may be seen, flourishing together, the trees, vegetables, fruit, and crops of various rich and fertile countries. Under a system of agricultural *mismanagement* so gross, that it would excite astonishment among the ignorant farmers in Europe, wheat is raised equal in weight to that of Kent or Essex. Grain and grasses can be produced in any quantities, in an extent of country greater than that of Great Britain, and more blest by nature. Potatoes grow luxuriantly; two crops can always be had in twelve months, and once, for the sake of experiment, three crops were brought to maturity in one year.

To explain the mode of farming is to detail all that should be condemned in husbandry. The soil is neglected, and never enriched by lime or manure, (though both abound,) because they are thought to heat the ground; the former, therefore, is left untouched in the quarry; the latter is burnt or thrown into the sea as a nuisance. The fields are uninclosed, and are scoured by successive crops, till they are exausted, when new land is broken up. The ploughs are of the clumsiest description; and when breaking up even light soil, they may be seen dragged by ten oxen, managed by two men and a boy, and accompanied perhaps by half a dozen of dogs. The other implements of husbandry are of the same miserable description, and equally requiring improvement in their construction. The grain produced by these unskilful means, instead of being thrashed, is trodden out by oxen, which are often fed on oats, cut green and dried, instead of hay. Thus it is, that this fertile region, with only 130,000 people to maintain, has more than once suffered actual want, from agricultural mismanagement; while at other times it has supplied St Helena, and recently even New South Wales, from the surplus produce of its naturally fertile soil. How desirable it would be, that the important isle of Mauritius which does not yield sufficient grain for the consumption of its own population, should have the benefit of the granary, which nature has thus established in its immediate neighbourhood? But however desirable it was, to feed the Mauritius from a British colony, the export of grain was prohibited in 1827, when that impolitic system was abandoned.

The first improvement that suggests itself therefore is, to afford farther encouragement to farming, by the appointment of an Agricultural Society, under the peculiar patronage of the Governor. The chief objects of this society ought to be, 1. To introduce better implements in husbandry; 2. To get the fields protected by inclosures; 3. To prove the advantage of lime and other manures; 4. To introduce judicious rotations of crops; 5. To ascertain by experiments the grasses and roots most suitable to the climate, and to give seeds to the enterprising and industrious; and 6. To reward the greatest extent of irrigation. By the adoption of such measures as these, 1. Labour would become lower, a great object where slaves, the dearest of all workmen, are the labourers; 2. Wheat would become cheap,—sufficiently abundant for exportation,—and would be saved from the fungus or rust, which often renders it useless for the mill, though it may be used as seed; 3. Oats, barley, and other white crops would become plentiful, and would be brought to market, *as grain,* instead of being prematurely cut down *as grass;* 4. New land might then be advantageously broken up, when the old arable soil is brought under an efficient system of husbandry; 5. Rye-grass, which, it has been proved, will flourish, would be extensively cultivated, and converted into hay, in such quantities, that the sheep and cattle of the western district, instead of being at a loss for forage, would multiply and be fattened, either for domestic or foreign consumption; 6. The fact also would be established, that lucern can be cut six times within the year, as has indeed been proved by actual experiment; and 7. Potatoes, which are already naturalized and cheap, would become cheaper, and be more generally used: mangel wurzel, beet-root and carrots, which all grow with a luxuriance no where surpassed, would contribute their ample supplies of food.

It would be a very important saving to government, and would furnish means for an expenditure that might at first be required for the above purposes, were the naval supplies drawn from the Cape, instead of being brought at a heavy cost from Britain. Beef from England must cost 1s. per lb. including all charges for freight, &c. whereas the navy contract for fresh beef at the Cape, is only 1¼d per lb.; but should it even be 3d. when cured, there remains a saving of 75 per cent. English biscuit also cannot be landed for less than 6d. though the navy contract at the Cape is 2¼d. per lb. making a difference of more than one half. If a preference were given to Cape provisions, and, till the supply became sufficient, only the smallest addition requisite were brought from Britain, it would be a great encouragement to the farmers and settlers in this colony.

SECT. 3.—*Proposed improvements at the Cape.*

Procuring an abundant supply of water, would be a fit object for the paternal care of the British Government, and would be of the utmost importance to the settlers in that colony. It would also be highly advantageous were Government to undertake the formation of good roads, easy communication being so indispensable to the prosperity of all countries, agricultural and commercial. At present, in an extent of above 700 miles, there are not much more than 50 miles of road, though farming productions, such as butter, &c. even now, overcome so formidable an obstacle, and reach the market at the distance of 600 miles.

It would essentially promote the benefit of the colony, if the Botanical Garden were restored, which has unfortunately been given up entirely to the plough; and where land is of so little value, and so great an extent belongs to Government, if the garden were made on a scale large enough for the purposes, both of agriculture and horticulture, and placed under the management of a skilful and active superintendent. It would also be highly beneficial, did it include a nursery, in which the seeds of all plants might be tried, and the most suitable sorts be disseminated gratis over the country, all the western half of which is still so bare of wood, that improvement is retarded, while the eastern division shows how admirably the chief productions or the world become naturalized in this happy soil and climate, and exhibit a most surprising luxuriance. The myrtle, quince, pomegranate, several varieties of the celastrus and lyceum flourish and grow by slips. The date, banana, shadock, guava and mango, mingle their Asiatic foliage and flavour with the grape, peach, plum, pear and apple of other regions. The oak attains great height and size in some parts of the colony. The chesnut, walnut, alder, and three sorts of pinus sylvestris are already introduced. The ash, beech, sicamore, larch, and spruce, are likely to suit the climate. The cedars of Lebanon and Bermuda would thrive. The cassada, or cassava, from the West Indies, or Brazil, might likewise be most advantageously introduced into both colonies. These measures respecting the Botanic Garden would be highly gratifying to the Dutch, who are so devoted to horticulture *.

SECT. 4.—*On Cape Wines.*

The chief article of commerce is wine, and vines have already increased tenfold, since the colony became British. But unfortunately more attention has been hitherto paid to quantity than to quality, except on the farms which yield Constantia. The latter have an eastern exposure, and are sheltered from the south-west, the only injurious blast. The soil being a deposit from the neighbouring mountains, is light, but enriched by manure. The subsoil, which is even more important, is still lighter, being mixed with sand and broken stone; on the contrary, in Drachenstein, where the chief vineyards are at present, the subsoil being clay, the wine receives an unpleasant flavour, the idea of which is inseparably associated with the very name of Cape wine. It is unnecessary to enter into the subject of its manufacture. If the subsoil be bad, so will the wine be. The vine does not require a rich subsoil. In Italy, flags are laid to prevent the roots from penetrating into clay; and in England, rubbish is thrown in to make a subsoil that shall not be so rich as to produce leaves, instead of fruit. It would be advantageous were premiums offered for wine that had not been produced from clay of subsoil, but had been reared in trellis, as requiring less labour than the standard, and made on a pure and good system, instead of being mixed with Cape brandy, or sulphuric acid, &c. Notwithstanding all these disadvantages, Cape wine is generally sold in England under the names, and at the prices, of Madeira, Sherry, Teneriffe, Stein, Pontac, and above all Hock.

---

* The premiums given by the Highland Society would furnish some excellent hints regarding some objects to be encouraged.

SECT. 5.—*Other improvements suggested.*

Merino sheep have been tried, and found to prosper. Two gentlemen fed a few on lucern; and of late, when the wool has been washed and rolled up in fleece, they get 1s. 6d. per lb. on delivery. It is now an article of export, being equal to that of Saxony or New South Wales, and should be encouraged.

The olive would most probably answer in a climate similar, but superior to that of Spain or Italy. It would be most desirable that Government should provide seeds, and have it fairly tried. The olea capensis and kigglario are all they have hitherto had as oil trees.

The mulberry grows luxuriantly from slips, and specimens of Cape silk have already reached England. This would likewise merit encouragement.

Tobacco thrives at the Moravian Missionary Establishment at Guadenthial, about seventy miles from Cape Town, to which it affords the chief supply of that article. Were it allowed to be imported into England, our colony at the Cape could in a few years yield a sufficient quantity to provide for the entire consumption of Britain.

Where the price of labour is so great from want of hands, indigo cannot repay the process required to bring it to market, though there are not only native varieties, but the plants of India, and of South America, flourish. This may be left to India.

From the same cause, cotton cannot yield a remunerating price, though the plant grows well at the Cape. This article should be left to the Mauritius.

SECT. 6.—*On the Mauritius.*

The Mauritius seems naturally dependent on the Cape, as the nearest country that can furnish it with provisions. Its wants can be supplied from the superabundant fertility of that rich portion of the great Continent, while it is better adapted for cotton, than the latter more important colony. Cotton ought to be the chief article of cultivation in this island. Its produce is among the best sorts brought to market. A great extent of land lying waste in the interior is calculated for that object. The cultivation of sugar has hitherto been forced in preference to cotton, and to the great injury of the West Indies, which can supply the whole markets of the world with an article possessing more saccharine matter, and consequently more valuable than the Mauritious can ever yield.

The cottons of the Mauritius are among the best in the world, while the sugar, though fair in colour, is decidedly of an inferior quality. Another argument for cotton being preferred to sugar is, that it requires less labour,—a great object where labour, and indeed many other things, are dearer than almost any where on the surface of the globe.

As the productions of the Mauritius are raised for foreign markets, the commodity that is most profitable should have the preference.

Slave labour, as already observed, is dearer than any other. As, however, it is at present indispensable, nothing can be done by way of improvement in that respect, except encouragement were given to free settlers, by small grants of the waste land, of which there still remains a great extent in this fertile island, and it is believed at the disposal of the Crown.

Measures suggested.

1. To establish at the Cape colonies of skilful farmers from England and Scotland, and to introduce there the improved system of husbandry, with iron ploughs, harrows, &c.
2. To erect, under the special patronage of the Governors, agricultural societies in both colonies.
3. To restore the Botanical Garden at the Cape, and place it under the care of an able Superintendent.
4. To send persons to the Cape conversant with the digging of wells, and the means of conveying water by aqueducts.
5. To give every encouragement to the cultivation of cotton, instead of sugar in the Mauritius, and to send a great number of settlers there, that it may soon be rendered a real British colony.
6. To send this paper to the governors of the Cape, and of the Mauritius, and to require from them their observation on the measures therein recommended, and on the best means of carrying them into effect.

JOHN SINCLAIR.

XXX.—*On the Bones procured from Butcher's Meat, and the Gelatine to be obtained therefrom. By. M.* D'ARCET*.

On the composition of bones, and their employment as an alimentary substance.—Bones form, as we may say, the frame-work of animals; they may be divided into two classes; namely, the compact bones, whether flat or cylindrical; these contain but little fat, and are sold to the turners, button-makers, fan-makers, &c.; and those bones which are not fit for these uses. These last consist of those which remain after the selection has been made for the above purposes; and are those which form the subject of D'Arcet's experiments. Their mean composition, after analysis, is nearly as follows, in the dry state:—

---

* From Ferussac's *Bulletin des Sciences Technologiques.*

Earthy substance	60
Gelatine	30
Fat	10
	100

These proportions served to establish the calculations upon, which are contained in this article. But as the heads of the larger bones contain more fat, so it was easy to make mixtures of them, containing either more fat or more gelatine, so as to take advantage of the one or the other of these products.

Ten *grammes* of gelatine suffices to animalize a *demi-litre* of water, making it equal to the best *bouillon* in cookery; or 100 *kilogrammes* of bones contain 30 kilogrammes. We may prepare with these 100 kilogrammes of bones, 3000 rations of *bouillon,* or 30 *bouillons* with 1 kilogramme; but one kilogramme of meat will only furnish 4 *bouillons;* the bones giving up to the water 7 times and a half more animal matter than the meat does.

We know that 100 kilogrammes of butcher's meat contains about 20 kilogrammes of bones; this quantity of meat will only afford 400 *bouillons,* whilst the 20 grammes of bones will serve to prepare 600; thus we see that we can prepare 5 *bouillons,* with the same quantity of meat, not deprived of its bones, which would otherwise furnish but two.

We may easily perceive the importance of these considerations, when we state, that the butcher's meat consumed in the department of the Seine, would furnish nearly 10 millions of kilogrammes of bones per annum; and that from this quantity we might obtain *eight hundred thousand* rations of *bouillon per* day! We see then, how desirable it is, that we should quickly organize the processes, by which we should obtain a result, so important for ameliorating the alimentary regimen of the poorer and less fortunate classes.

On breaking the bones.

The bones intended for alimentary uses, must not be crushed or broken by redoubled strokes, as they would thus contract an odour highly disagreeable. They ought therefore to be crushed at once, by a single stroke, either between channelled cast-iron cylinders, or under a rammer sufficiently heavy; if we have only a few bones to break daily, we can employ a horizontal lever, similar to those employed by the manufacturers of printed calicoes and paper hangings; or an anvil and a mallet. In either case, if we take care to steep the fragments of bones in water, before we submit them to a new breaking, we can reduce them to fragments sufficiently small, without their contracting that ill odour; but if they are not immediately used, they can only be preserved good by one of the following methods, viz.

On the Preservation of the Bones.

In order to preserve the bones for a few days only, we must keep them plunged in a current of water—in cold water, continually renewed; or in salt water. But we cannot preserve them for several years by following these methods; and yet it is important to be able to do so, in order that bones may assume their proper place, amongst alimentary substances.

The cause of the alteration in the bones is the fat which they contain, which soon becomes rancid. The processes for preserving the bones must therefore have for their objects the freeing them from fat, to prevent them from becoming rancid, and also of guarding the gelatine in them from the action of humidity. We may obtain these results by three different means.

The first is, after cleansing and breaking the bones, to boil them in a cauldron filled with water, in order to extract the fat; then to wash them in hot water, and dry them on nets, either in a drying loft well ventilated, or in a stove heated to a convenient degree. The bones thus treated afford plenty of fat; but they still retain a great quantity, which will not permit of their being long kept, without acquiring a rancid odour.

It has been proposed to take the bones, washed as above directed, and to boil them in a caustic lye; then to wash them in plenty of water, and dry them in the open air, or in a stove. Thus prepared, the bones may be easily preserved; and may be exported afar with success. But this operation requires great care; and it is seldom that we do not either find the gelatine of the bones altered, so as to be rancid, or to contract the taste of soap, which forms upon their surface; and from which it is difficult to free them, owing to the excess of fat which remains in them.

The third means is salting them; but this is too expensive, and is not convenient for the naval service, which requires fresh aliments, not salted ones; and which should, besides, occupy the smallest space possible.

Each of these processes then still leaves much to be desired. M. D'Arcet, therefore, has an idea of employing the ingenious method contrived by M. Plowden; and which consists, in plunging the bones which we would preserve in a strong solution of gelatine, and afterwards drying them in the open air. He would thus render the bones capable of being preserved as fresh as possible. The following is the process:—

He takes a solution of gelatine, containing about twenty hundredth part of the dry gelatine, and heats it, to from 80 to 90 centigrade degrees, and then repeatedly dips the cleansed and broken bones in it. These he then exposes on nets in the open air to dry; he then dips them again in the solution of gelatine, and dries them perfectly, as before. He even recommends a third immersion, in order to obtain a still thicker layer of gelatine; when, after drying them in the open air, he places them in a stove, heated to, from twenty to twenty-five degrees, in order to gain a perfect dessiccation. When brought to this state, each piece of bone is thus *clothed,* and preserved from the humidity of the air; and the bones can thus be easily preserved.

On the different Processes formerly employed to Extract the Gelatine from Bones.

It appears that it was only in the year 1681, that they began to extract the animal matters from bones, with a view to our object. Papin employed the digester, which bears his name, for this purpose. We have endeavoured to avail ourselves of this process; but the precautions which are necessary to be taken in the use of this apparatus, and the alteration which the gelatine undergoes, have caused us to abandon it. Latterly, a great number of persons, amongst whom were several scientific philanthrophists, have made numerous experiments, in order to extract the gelatine of bones, by boiling them in water, under the ordinary pressure of the atmosphere; but the expences of the fuel and labour, and the little gelatine obtained, in proportion to the quantity of bones employed, have caused them to desist, and no useful application has been made of their experiments. M. D'Arcet also completely perfected the art of extracting the gelatine from bones by means of acids. But, unfortunately, circumstances, independent of his controul, have hindered this process from becoming generally adopted. The goodness of the products obtained, did not always answer the expectations of the consumers, and the sale of the alimentary gelatine has diminished; and the little which is at present used, is prepared by means analogous to those employed by Papin. Always fully persuaded of the great services which the use of this gelatine would render, M. D'Arcet has continued his labours, and has lately found a new means of obtaining it, for which he has obtained a *brevet* *d'invention;* and has made an application of it in *l'Hospice de la Charite.*

Description of the Process actually employed at l'Hospital de la Charite, for Extracting the Gelatine contained in Bones in the large way; and for Preparing about a Thousand Gelatinous Rations daily.

This process consists *in exposing the bones to the long continued action of steam, under a low pressure;* and it owes its success to the steam being pressed into the pores of the bones, where it first expels the fat, and finally dissolves the whole of the gelatine contained in them. This process has indeed formerly been employed, under an ancient process in pharmacy, and which is cited in Beaume's *Elémens de Pharmacie;* but it is for its regulation, and application on a great scale, that we are now indebted to M. D'Arcet.

Knowing, from experience, that it requires at least four days, to extract all the gelatine contained in bones, in order to procure it of a good quality. M. D'Arcet has constructed an apparatus, consisting of four cylindrical vessels, all of one capacity.

These vessels should either be made of tin, or of sheet-iron well tinned; or which is still better, double, containing a sheet of tin inside, of two or three *milimétres* in thickness. It is necessary to avoid the use of copper or lead, in order that the salubrity of the gelatine may be placed beyond doubt. The proportion between the height and the diameter of these vessels may vary, according to the quantity of gelatine you would obtain in solution, in the condensed water from the steam; as the greater the cubical surface of the vessel is, the more water it will condense per hour; but then it will contain fewer bones, and *vice versa.* Upon the upper part of the cylinder a cock is placed to admit the steam; and in its lower part, another cock is fixed, to draw off the gelatinous solution at. A cover, hermetically fitted, is adjusted to each vessel. In order to operate, we take the broken bones, either fresh, or preserved by any fit means, and place them in a cage, made of tinned-iron-wire, of the form of the vessel, and place them within the vessel; and also take care to close it securely before the steam is admitted. Soon afterwards we may draw off at the lower cock, the first gelatinous solution, highly charged with fat. The bones requiring four days, as we have before stated, to be entirely deprived of their gelatine by this method; we operate in the following manner: we each day fill one cylinder only; and in order to pursue a regular course, we unite, after each drawing off, all the liquids which pass through the four cocks; and thus obtain a solution always of the same strength. The cage containing the bones can be attached by an ear, to a hook, which is hung to a cord, passing over the pulley of a crane, firmly secured to the floor of the room; so that it is easy to place it in, and to remove it from the cylinder, when the bones have become exhausted, and require to be replaced by another charge of fresh bones.

In order to obtain the best results from the use of this apparatus, the following conditions must be fulfilled.

First, the bones must be broken into small pieces; and those which are the most compact into still lesser morsels; they being more loaded with fat, and which they will then yield more readily, and at a much lower temperature.

Secondly, the broken bones ought to be previously freed from the fat as much as possible, by means of boiling water; either contained in an ordinary boiler, or in the cylinder, into which steam may be introduced under the ordinary pressure of the atmosphere; or the water may also be heated by means of steam.

Thirdly, the steam must be less compressed, and the time of the process prolonged, when we would obtain the gelatine more pure, and capable of making a better jelly.

Fourthly, we must hinder the condensation of the steam in the cylinders, when we would obtain the a more concentrated gelatinous solution ; and act in a contrary manner, when the solution of gelatine is merely intended to replace the *bouillon*, or to animalize aliments of a vegetable nature.

Fifthly, we can sensibly augment the products of the apparatus, without expending much more combustible materials, by preparing the gelatinous solutions in a highly concentrated form; and we can easily reduce these solutions to the convenient strength, by employing boiling water at the moment of using them.

Sixthly, throughout the process the strength of the steam should be varied, according to the effect we would produce; experience has, nevertheless, shewn, that the most advantageous state of the steam is, when it does not exceed 106 or 107 degrees of the centigrade thermometer; that is to say, when it supports a column of mercury, not more than 960 milimetres high; the cocks which serve to introduce the steam, afford us the opportunity of varying the pressure of the steam at pleasure, on bringing it into contact with the bones; and we should take care to regulate their openings, which is easily done, by consulting the thermometers, which are placed in the upper part of each cylinder; or still better, at the extremity of the tube which conducts the steam to them.

Seventhly, in order not to interrupt the progress of the process, and as there may arise a necessity occasionally, to repair the apparatus; so it is well to have an extra cylinder provided.

Eighthly, the apparatus should be constantly kept in good order; and we cannot too strongly recommend, that the gelatinous solutions be constantly preserved, either in vessels formed of iron tinned, or of well burned earthenware; and which should be frequently cleansed with scalding hot water. The cleanliness of the vessels contributing greatly to the preservation of the gelatine, or the gelatinous solutions which may be kept in them.

On the Gelatinous Solutions obtained by this Apparatus, and their Use.

The gelatinous solutions, produced by means of M. D'Arcet's apparatus, may be drawn off perfectly clear, provided we suffer the liquor to escape by degrees, and also hinder the steam from escaping at the lower cocks. The gelatine is tasteless; and as M. D'Arcet observes, not like to that which the name of *bouillon d'os* has been given; but on the contrary, *contains no other matter, than such as is found in the best bouillon made from butcher's meat*; and when seasoned, and mixed with a little viands, or legumes, it may very well rank immediately after it; and indeed, on account of its *low price*, it ought to be preferred to it, in all those cases where we are obliged to take economy into consideration.

When diluted to the point of containing only five or six-hundredths of dry gelatine, this solution serves to prepare the alimentary jellies for colds; such as those of orange, citron, &c., when conveniently aromatized. When we reduce the quantity of dry gelatine to two-hundredths, it serves to *animalize* all the other aliments of a vegetable nature. When evaporated to a certain degree, it forms gelatinous tablets, or the *tablettes de bouillon*. We might easily enter, did our limits permit, into the preparation of the farinas and legumes, baked and dried—such as those made by M. Duvergier; also into that of the *ter-ouen*, and other alimentary substances, extracted from the potato, by M. Tenaux, at St. Ouen; the gelatine will also serve to *animalize* biscuits. (M. D'Arcet has made experiments upon this subject, and these biscuits served to provision the vessel, in which M. Durville went round the world.)

Lastly, when mixed with various farinas, or the fecula of the potato, and the sugar of that fecula, it may be employed to make a bread, of as good a quality, and as nutritive, as that made from the best wheat! M. D'Arcet is now actually occupied in this pursuit.

According to the observations of Mr. Bornand, relative to gelatine, we find that the most advantageous and economical employment of it, consists in combining it with the other materials for making bread, in the form of a *bouillon*. If this has been well freed from the fat, it is quite impossible to distinguish it by its taste; and it prevents the bread from soon becoming mouldy. If, however, we suffer the fat to remain, we shall then form a kind of cakes, of an agreeable taste, and which keep better than those prepared with butter. When this bread has been dried a little, it may be pulverized under a rolling millstone, and will then afford a sort of farina, or semolina, very savoury and nourishing, which will serve to make good broths; and may be advantageously mixed with other alimentary substances, of but little nutritive qualities. This farina may be easily carried, and contains much nourishment in a small volume.

With respect to the nutritive quality of the gelatinous solution, this has been decided some years ago. In 1824, the Faculty of Medicine made a Report on the gelatine, which M. D'Arcet prepared by means of acid from bones; and which Report has since been reprinted, with notes, by the author of this useful product; so that we have no longer any doubt upon the subject. It is sufficient to recal the notice of our readers, to the experiments made at *l'Hospice de Clinique Interne de la Faculté* of Paris, under the eyes of the physicians, charged to make a report thereon. During three months, the *bouillon* was prepared, with a fourth part only, of the viands usually employed; the other four parts being replaced by gelatine, and the legumes. This was given with roast meat, both to the sick and the convalescent; and in this employment of it, there was not perceived any difference between the effects of this *bouillon*, and that which had been formerly given to them; it was also abundantly nourishing, and as satisfactory when used together with the roast meat, as the ordinary *bouillon*.

"We then already see, that one part of this question is answered. The *bouillon*, prepared according to M. D'Arcet's process, is at least as *agreeable*, as the ordinary *bouillon* of the hospitals; and with respect to its *salubrity*, we are assured, that the forty persons who made use of it, during three months, experienced no ill effects, which could be reasonably attributed to the gelatine; their maladies followed their usual course, and they were not longer in becoming convalescent, than under other circumstances.

"We therefore submit, that we have a right to conclude with certainty, not only that this gelatine is nourishing, and easy of digestion, but also, that *it is highly salubrious;* and not likely, when employed as proposed by M. D'Arcet, to produce any ill effects upon the animal economy."

M. D'Arcet repeats an important observation, originally made by M. Braconnet, that the hydrochlorate and the phosphate of potash, which we find in the viands, contribute much more than we think, to the agreeable flavour of the *bouillon*. This has been proved by experience; and after making many trials, he has arrived at this result, that a mixture of 30 parts of chlorate of potash, and 70 of marine salt, is best to employ, to salt the aliments, *animalized* with the gelatine.

The following are recipes for preparing *bouillon* with a gelatinous solution, procured by treating bones with steam:

The best household *bouillon* should not contain less, than from one to two-hundredths of animal substance; and we should therefore give this title to the gelatinous solution which we would convert into *bouillon*.

Supposing that we would prepare a *bouillon* with vegetables only, without any other viands, we salt, with the saline mixture, of which we have above given the receipt, a solution, containing about 200 grammes of dry gelatine per litre; and colour it, either with *caramel*, a strong decoction of scorched carrots, or a roasted onion; and if we put in a little kitchen fat, we shall, no doubt, find it floating upon the surface of the *bouillon;* we may also flavour it with a little dried sorrel, or any other analogous preparation. Or, still better, we may dress 1 kilogramme of vegetables, such as parsnips, carrots, onions, leeks, and celery, in 5 litres of the gelatinous solution, properly salted, and aromatized with three cloves; together with a sufficiency of kitchen fat, and colouring materials; and when the vegetables are sufficiently dressed, they may be taken out, and we then add a little sorrel.

In order to make a *bouillon* of bones with viands, we take 5 litres of the gelatinous solution, and 500 grammes (1 pound) of viands; we then salt and scum it, and add 750 grammes of vegetables, such as those abovementioned, three cloves, and a sufficient quantity of kitchen-fat; we then cover it, and suffer it to boil gently, until the viands are dressed. We shall, perhaps, then obtain about 4 litres of *bouillon,* which would otherwise have required us to employ 4 pounds of viands; and we shall thus save about 3 pounds of the viands, which we must otherwise have used, according to the nature and value of the other aliments. The necessary expences of nourishing a family by the ordinary means, according to the calculation of M. Puymaurin, Director of the Mint, is as follows:—

6 pounds of viands, for 5 persons, for 4 days.	francs.	centiemes.
Price of the viands, 45 centiemes the pound .	2	70
Vegetables for the *marmite*.		10
Additional vegetables, and other substances, at 20 centiemes per head, per day	4	
Total, for 5 persons, for 4 days, bread not included	6	80
But, by employing the gelatine, 5 dinners per day; or 2 litres of *bouillon,* and 2 pounds of *ragouts,* the whole for 4 days, costs only		80
1 pound and a half of meat for the spit, or ragouts	2	70
	3	50
Difference in economy for 4 days	3	30
For 1 month	24	
For a year	288	

On the Fat, extracted from Bones, procured from Butcher's Meat.

As soon as the bones are placed in this apparatus, the steam acts so as to cause the fat in them to melt, and to escape with facility from the interior of the bones; and it is afterwards drawn off by the lower cocks in the cylinders. This is a very expeditious method; and the fat would be excellent, were it not that a large quantity of it is converted into a calcareous soap. Now, as in hospitals, this fat is as valuable as butter; so we should endeavour to obtain as large a quantity as possible. Its quality is also better when the fat has been exposed to a lower temperature. M. D'Arcet therefore advises us to separate part of the fat in the bones, by treating them in boiling water, in the usual manner. In order to preserve the fat thus obtained, he melts it in a water-bath, passes it through a linen cloth, or a fine sieve, and washes it with hot water, in order to free it from the gelatine; he then again places it in the water-bath for some time, in order to draw off the clear fat, separate from the water; when it may either be salted, preserved by Appert's process, or in bladders. It will be found good enough to be employed for alimentary purposes; or it may be used in the manufacture of soap, or for other purposes.

On the Residuum of the Bones, after the Steam has acted upon them in the Cylinders.

The remains of the bones, in M. D'Arcet's apparatus, when the process has been well conducted, are always brittle, and easily reduced to powder. After being washed in water, and well dried, they still contain a little gelatine, but in a very small quantity; sometimes they will not afford ammonia on distilling them; and if they burn with a flame, it is owing to the calcareous soap which they contain.

What use then can we make of this substance? M.

D'Arcet thinks, that it may serve for manure, and improve the quality of the soil (there have, however, been some experiments made with it, which leads us to despair of any good resulting from it) several experienced agriculturalists are now making trials of it, with a view to decide this interesting question. However this may be, it will certainly answer for preparing phosphorous, for making cupels, and for polishing metals; and we may replace the gelatine by any combustible azotic matters—such as soap, with a base of either potash or soda, made with old leather, or the refuse of fish; at any rate, it will be proper to be converted, by burning it in close vessels, into decolouring charcoal.

On the production of the Steam, to be employed in extracting the Gelatine from Bones.

The most economical method of procuring steam to be employed in this apparatus, would be, beyond all doubt, to connect it with the boiler of a steam-engine; or with any other apparatus, necessary to be continually employed to produce steam, and so as to make use of the heat lost, when the combustibles employed are heated to redness. When, however, neither of these economical methods can be employed, we must produce steam by means of a boiler, destined particularly for this use. The following rules for the establishment of this apparatus must also be observed:

The number of litres of the gelatinous solution to be obtained daily, indicates the quantity of bones to be used. The capacity of the cylinders can, therefore, be easily calculated from this data, that the hectolitre of the bones weighs 48 kilogrammes. Each cylinder being also three times the height of its diameter, it is easy to calculate it surface. This proportion leads us to the determination the quantity of steam to be employed; and, of cours fixes the dimensions of the boiler, and its furnace.

It is of importance to observe, that we should never the boiler with stagnant water, nor with that containi ammoniacal salts; and also observe, not to employ s water as would load the boiler with a compact deposit; and likewise avoid the use of all substances, which might give an ill smell to the steam. It fact, we should otherwise run the risk of obtaining gelatinous solutions, having a disagreeable smell and flavour, and totally unfit for the nourishment of man.

On other Applications which may be made of this Apparatus.

M. D'Arcet supposes the apparatus to be established on board of a steam-boat, furnished with a stock of the bones coated with gelatine, as above described; when the four cylinders may also occasionally be employed in distilling fresh water from sea-water, the condensation being effected by contact of the air.

With the bones we may prepare a thousand rations of the gelatinous solutions every twenty-four hours, and thus economise three-fourths of the viands, ordinarily used in the preparation of the fat *bouillon*; and also *animalize* the broths, and other aliments of a vegetable nature, which are used. And still more; as the solution assumes the form of a jelly, on cooling, so we may aromatize it with the syrups of citrons, or orange-flowers; or ameliorate the other messes, which form the alimentary regimen of the naval service.

The dressing of vegetables by steam, may very readily be effected, by filling the wire cages with the vegetables instead of bones, and leaving them exposed for thirty or forty minutes to the action of the steam. This apparatus may likewise be employed, as a powerful and highly agreeable means, of heating and drying the clothes of the sailors.

It is undoubtedly on board steam-boats, that the use of this apparatus is attended with the greatest advantages; nevertheless, it is scarcely less advantageous, wherever we find a steam-boiler kept in constant activity; and there now hardly exists a manufactory without its steam-engine.

Otherwise, a steam-boiler may be constructed for this express purpose, without incurring any very great expence; and the applications of the apparatus may be extended to the bleaching of linen by steam; to the preparation of hemp and flax; to the making gelatinous solutions with salted bones, which may serve to *animalize* the residuums of potatoes. C.

XXXI.—*On the Progress of Mechanical Discoveries. By the late celebrated* WILLIAM NICHOLSON *.

"The folly and consequent distress of pursuing experiments in chemistry, for the sole purpose of commercial advantage, has been repeatedly observed, both by public writers, and in private life. The obscurity which attends the processes of this art, the imperfections of theory, and the seductions of hope, have united to lead men in pursuit of medicines of uncommon power, and agents, which should convert the cheaper metals into gold and silver. It is a subject of no wonder to those who have not suffered their mental habits to be vitiated by these seductive analogies, that difficulties and disappointment should attend the life of a man thus employed. But mechanics have, in general, been more favourably regarded. A number of simple and admirably useful effects are produced by the operation of machines. We daily see improvements produced by means easily understood. The mechanic, who endeavours to strike into a new path, finds he can reason from what has been done before him; and usually begins his work, with a conviction, that the results he is desirable of attaining, will infallibly happen. Hence it is, that a prodigious number of new schemes find their way into books, on which both the author and reader set a high value; and of which the futility is discerned only by a few practical men. Some of my readers have supposed this source of information to be much more productive than it really is. A very slight inquiry concerning new machines and inventions, whether they have been carried into effect, and whether they have superseded the old methods of operation, will immediately strike out of the list of valuable articles, not less than *nine-tenths* of the objects, to which the public attention is solicited! And if it be asserted, that the description of such abortive projects might be of use to afford hints to speculators, I must take the liberty to observe, that it is a very serious thing to engage in a new invention; and a no less serious duty in the editor of a public work, to be well assured of the value of what he recommends, or suffers to recommend itself to his readers. From views of this kind, it has appeared to me, that I should do some service to an active set of men, some of whom have effectually served this country, if I were concisely to point out the course of mechanical invention, in order that those individuals only, may be induced to engage in it, who possess the acquisitions and means to do it with some effect.

---

* From his quarto *Philosophical Journal*.

"We will therefore suppose a very acute *theorist,* who is not himself a workman, nor in the habit of superintending the practical execution of machinery, to have conceived the notion of some new combination of the mechanical powers, to produce a determinate effect; and for the sake of perspicuity, let us take the example of *a machine to cut files.* He knows that the notches in a file are cut with a chisel, driven by a blow with the hammer, by a man whose hands are employed in applying these instruments, while his foot is exerted in holding the file on an anvil, by means of a strap. Hence he concludes, that it must be a very easy operation, to fix the chisel in a machine, and cause it to rise and fall by a lever, while a tilt hammer, of the proper size and figure, gives the blow. But, as his attention becomes fixed, other demands arise, and the subject expands before him. The file must be supported upon a bed or mass of iron, of wood, of lead, or other material;

it must be fixed, either by screws or wedges, or weights, or some other ready contrivance; and the file itself, or else the chisel, with its apparatus for striking, must be moved through equal determinate spaces, during the interval between stroke and stroke, which may be done either by a ratchet-wheel, or other escapement, or by a screw. He must examine all these objects, and his stock of means in detail; fix upon such methods as he conceives to be most deserving of preference; combine, organize, and arrange the whole in his mind; for which purpose, solitude, darkness, and no small degree of mental effort, will be required. And when this process is considerably advanced, he must have recourse to his drawing-board. Measured plans and sections will then shew him many things, which his imagination before disregarded. New arrangements to be made, and unforeseen difficulties to be overcome, will infallibly present themselves. The first conception, or what the world calls the invention, required an infinitely small portion of the ability he must now exert. We will suppose, however, that he has completed his drawings. Still he possesses the form of a machine only; but whether it shall answer his purpose, depends on his knowledge of his materials. Stone, wood, brass, lead, iron, forged or cast, and steel in all its various modifications, are before him; the general process of the workshop, by which firmness, truth, and accuracy, are alone to be obtained; and those methods of treatment, chemical as well as mechanical, which the several articles demand: these, and numberless other practical objects, call for that skill and attention, which may either lead to success; or, by their deficiency, expose him to the ignorance or obstinacy of his workmen. If he should find his powers deficient, under a prospect so arduous—if he cannot submit to the severe discipline, of seeing his plans reversed, and his hopes repeatedly deferred—if unsuccessful experiment should produce anguish, without affording instruction, what will then remain for him to do? Will he embitter his life, by directing his incessant efforts, his powers and resources, to a fascinating object, in which his difficulties daily increase; or will he make that strong exertion of candour and fortitude, which will lead him to abandon it at once?

"These are the inevitable stages of operation, through which every inventor in mechanics must pass. To the mere habit of viewing objects in new lights, the habit which leads to the outline of invention, he must add the power of disposing his notions in the form of an individual engine or instrument; and he must himself become a workman, capable of discerning the means by which his ideas may become realized in the proper materials. It may perhaps seem as if I had selected an instance of difficulty, and indulged my imagination in a sketch of obstacles, seldom likely to be met with. This, however, is far from being the case *. Nothing seems more simple and easy, at first sight, than to make an engine to cut notches in a piece of steel; and a very ingenious person, in the American Philosophical Transactions, has accordingly given an accurate design of an engine for that purpose; which, no doubt, he thought would succeed. But manufacturers well know the value of such an engine, and have long ago attempted to make it, by that, and various other methods, without success. That engine, in particular, promising as it appears, is utterly incapable of working, for several reasons, scarcely to be discovered, but by practical men; but which cannot with sufficient brevity be here detailed. And with regard to general obstacles in the detail of inventions, I am so far from magnifying them, that I am warranted by much experience, as well on my own behalf, as that of others, whose plans and operations have come before me, to affirm, that no mechanical invention, really new, was ever brought to its complete, or perfect state, *at so small a charge, as three times the cost of the finished*

---

* There is no doubt but that Mr. Nicholson had himself experienced the difficulties he here so ably and feelingly narrates, *as he had patented a machine to cut files.* EDITOR.

engine, exclusive of the incalculable labour of the contriver!"

Remarks. By the EDITOR.

If then, so much difficulty is inevitably experienced, in the attempt to improve any engine of importance, in our extensive manufactures, how much are the public indebted to the laborious exertions of those individuals, who have succeeded therein. The rapid increase of the cotton trade in particular, and of others also, appears to have been owing to the more liberal introduction of machinery into every part of them. The utility and policy of employing machines to shorten labour, has, indeed, been a subject, which has frequently exercised the pens of many ingenious writers; while their introduction into almost every branch of manufacture, has been attended, in the outset, with much riot and disorder. *They are, undoubtedly, wonderful productions of human genius; the progressive exertions of which neither can, nor ought to be stopped!* They enable a manufacturer to produce a *better* and *cheaper* article, than can be made by hand; in consequence of *the certainty and uniformity of their operations!*

XXXII. *On the Progress of Inventions connected with Navigable Canals.*

(Concluded from Vol. IV. page 319.)

THIS structure was certainly a lock, as we see by a note upon the passage, describing an improvement which was made within the same century, by the addition of a third gate, thereby converting it into a double lock. From this note, it is evident that the original structure permitted the passage of vessels, which William only rendered more secure during the high floods of the Lech, by the construction of the third gate, on the side next that river; thereby forming two chambers, instead of one; and by the care that is taken to mention the name of this artist, it appears that the original, or single lock, was not considered as any new invention. There is, therefore, strong reason to believe, that in Holland, the lock was known, and in use, at least a century before its application in Italy."

We agree in the above opinion, that the construction of locks is not yet, perhaps, brought to that degree of perfection, of which it is susceptible. An easy passage for the boats, durability, and the least possible expense of water, seem to be the principal ends to be had in view, in forming locks. Some of the locks on the most celebrated canals, built a century or two ago, are very deficient in some of these particulars. Such, for example, are those on the canal of Languedoc, that noble work, which unites the Atlantic to the Mediterranean. These locks are oval, or, in some instances, in a circular shape, in the plan; forms adopted, from a false idea, that the pressure of the earth behind the walls, would thrust them inwards. The consequence of this form is, that a large quantity of water is lost on the passage of every boat. The effect of the earth, to overthrow walls built straight on the horizontal line, has been proved by the permanence of subsequent works, built in this manner, to be of no great amount, when they are properly constructed. The walls should always be built of masonry, if, indeed, iron should not eventually be introduced. The profile, or figure given to the lock, as represented by a cross section, is of great importance; as on this, the stability of the walls, in a great measure, depends. The walls should retreat, or batter, as they rise, the batter being more considerable at the bottom, and decreasing as the walls ascend; at their summit they should become nearly vertical. An inverted arch, sprung from the bottom of each wall, gives them an admirable support, preventing them from sliding inwards, and against this it is necessary to have some guard.

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since July 25, 1829.

To George Straker, of South Shields, in the county of Durham, ship-builder; for an improvement in ships's windlasses. Dated July 25, 1829.—To be specified in two months.

To Louis Quetin, of great Winchester-street, in the city of London, professor of mathematics, who in consequence of a communication made to him by a certain person residing abroad, is in possession of an invention, of a new or improved vehicle, or combination of vehicles, for the carriage or conveyance of passengers, and also luggage and goods; constructed upon a principle of security against overturning or upsetting, and possessing other advantages. Dated July 25, 1829.—In six months.

To Francis Horatio Nelson Drake, of Colyton-house, in the county of Devon, Esq.; who, in consequence of a communication made to him, by a certain foreigner residing abroad, is in possession of certain improvements in tiles, for covering houses and other buildings. Dated July 25, 1829. —In six months.

To John Nicholls, of Pershall, in the county of Stafford, gentleman; for certain improvements in the lever, and in the application of its power. Dated July 25, 1829.—In two months.

To John Hutchinson, of Liverpool, in the county palatine of Lancaster, merchant; for certain improvements in machinery for spinning cotton, silk, linen, woollen, and other fibrous substances; which improvements have been communicated to him by a certain foreigner residing abroad. Dated July 30, 1829.—In six months.

To Joshua Bates, of Bishopgate-street, in the city of London, merchant; who, in consequence of a communication made to him, by a certain foreigner residing abroad, is in possession of a new process, or method of whitening sugars. Dated August 1, 1829.—In six months.

To Joshua Bates, of Bishopgate-street, in the city of London, merchant; who, in consequence of a communication, made to him by a certain foreigner residing abroad, is in possession of an improved method of constructing steam-boilers, or generators; whereby the bulk of the boiler or generator, and the consumption of fuel, are considerably reduced. Dated August 1, 1829.—In six months.

To Nathaniel Jocelyn, of Newhaven, State of Connecticut, in North-America; but now residing in the city of London, artist; who in consequence of a communication from foreigners residing abroad, and from much study of his own, is in possession of certain improvements in the preparation or manufacture of blank forms for banker's chéques, bills of exchange, promissory notes, post bills, and other similar instruments, or securities for the exchange or payments of monies; by which forgeries and alterations in the same, are prevented or detected. Dated August 3, 1829. In four months.

To Thomas Bailey, of Leicester, frame-smith; for certain improvements on machinery, for making lace. Dated August 5, 1829.—In six months.

To Thomas Brown, of Birmingham, in the county of Warwick, coach-maker; for an improved coach, particularly adapted for public conveyance and luggage. Dated August 5, 1829,—In six months.

To William Shand, of Burn, in Kincairdineshire, in that part of the United Kingdom, called Scotland, Esq.; for a certain improvement or improvements in distillation. Dated August 10, 1829.—In six months.

To John M'Leod, Esq. of Westminster, Surgeon; on the Madras establishment; for improvements in preparing or manufacturing certain substances, so as to produce barilla. Dated August 10. 1829.—In two months.

To James Rowland, of Heneage-street, Brook-lane, Spitalfields, in the county of Middlesex; and Charles M'Millan, of the same place, engineers, and mill-wrights; for a new or improved process or mode of constructing, forming, or making street-ways, carriage-roads, and high-ways in general. Dated August 11, 1829.—In six months.

To Thomas Hall Rolfe, of Cheapside, in the city of

London; musical instrument maker; for an improvement or improvements upon the self-acting piano-forte. Dated August 11, 1829.—In six months.

To Edward Weeks, of Kings-road, Chelsea, in the county of Middlesex, horticultural builder; for certain improvements in raising, lowering, or conveying heated water, or other fluids to various distances. Dated August 14, 1829.—In six months.

To Henry Cruger Price, and Charles Fox Price, of the city of Bristol, ironmongers; for an improvement in and upon certain apparatus, already known, for the communicating of heat, by means of the circulation of fluids. Dated August 20, 1829.- In six months.

To John Mushet, of York-square, Regents-park, in the parish of St. Pancras, in the county of Middlesex, gentleman; in consequence of his father, William Mushet, late of the city of York, doctor in medicine, and a member, and fellow of the royal college of physicians, deceased; having discovered to him a certain medicine, which, in the course of his practice, he found of essential and peculiar benefit in gouty affections of the stomach, spasms, cramps, inflammation of the lungs, violent and confirmed coughs, pains after child birth, and in other pains in the breast and bowels, beyond any other medicine, or application in like cases. Dated August 20, 1829.—In two months.

To John Jones, of Leeds, in the county of York, brushmaker; for certain improvements in machinery or apparatus, for dressing and finishing woollen cloths. Dated August 21, 1829.—In six months.

To William Rodger, of Norfolk-street ,Strand, in the county of Middlesex, lieutenant in the royal navy; for certain improvements in the construction of anchors. Dated August 21, 1829.—In six months.

To William Shand, of the Burn, in Kincairdineshire, in that part of the United Kingdom, called Scotland, Esq.; for a certain improvement or improvements in distillation and evaporation. Dated August 21, 1829.—In six months.

GILL'S
TECHNOLOGICAL & MICROSCOPIC REPOSITORY.

XXXIII.—*On the Microscope. By* THOMAS CARPENTER, *Esq. With Remarks and Additions. By the* EDITOR.

WITH A PLATE.

DEAR SIR, *London, September 10th* 1829.

ABOUT three years since, I was on a visit at a friend's house, who is a very large hop grower, in the neighbourhood of Canterbury, and was informed by him, that the hop-pickers in his plantation frequently met with a very beautiful insect, which they termed the hop-dog. As I could not learn from him what this insect was, he not being conversant with entomology, and not knowing it by the name given it by his people, I requested him to send me a few the next season, which he promised to do, and faithfully kept his word, by sending a small box to my house containing some.

As I was anxious to see these insects, and more particularly as he had described them to be so very beautiful so I quickly opened the box, and was indeed much disappointed, in not finding something rare and splendid in it, the whole of its contents being nothing more than a few caterpillars, of the light coloured tussock moth—*species pudibunda.* However, I thought I might furnish myself and friends with some fine specimens of the perfect insect, by breeding them; I was enabled to do so, as the caterpillars were at that time about to change into their crysallis state.—One or two of the caterpillars being dead, also enabled me to furnish myself with a few objects for my microscope. A portion of hairs, with which these insects are covered, I placed between two slips of glass, and found them to be curious microscopic objects; these I now send for your inspection: also, a few of the feet, some of which I have placed on a piece of card, and others between slips of glass, to be viewed either as transparent or opaque objects. You will observe numerous minute slender horny hooks or claws, of different lengths, attached to each foot, which under the microscope somewhat resemble fish hooks. The sole, or that part within the claws, is capable of opening and shutting. When the insect walks, and that it may not impede its motion, it is shut, and the claws are laid flat, with their points turned inwards; but when it wishes to fix itself, the sole is opened, becoming of greater diameter than before, and the claws stand erect, with their points outwards; by means of these, the insect is enabled to cling to smooth surfaces, and to grasp the smallest twigs, to which the legs could not possibly adhere; a circumstance which the flexible nature of the feet greatly facilitates. The caterpillars I also send, that you may examine their curious eyes; they are but few in number;—but when the perfect insect is produced, it possesses many thousands, each apparent eye being a cluster of compound ones. I likewise send you one of the moths, which I bred from the caterpillars, with a few of the scales, taken from off one of the wings, and placed between slips of glass. These you will find to possess curious forms and characters. With these you will also receive slips of glass, containing between each, very singular hairs, taken from other species of tussock caterpillars; these are well worth your inspection; as they differ very much from the hairs before mentioned. In your last number I mentioned a species of boat-fly, whose compound eye had been injured; and a small portion of which you have figured in plate III. fig. 4; since then, I have dissected the rostrum of the same fly, and found within it three powerful instruments, which appear to be constructed for the purpose of wounding and extracting the juices from aquatic plants and insects, from which the boat-fly derives its nourishment. Two of these instruments ~~are serrated~~ somewhat similar to the darts in the sting of a bee; the other instrument is more powerful than these, and is probably used by the insect for the purpose of tearing open the skins of plants and insects to extract and suck up its food. I have placed these three instruments between two slips of glass, and which also contain the sheath, from which I took them out. And between other slips of glass, I have placed the wing-cases of a different species of boat-fly, which you will find marked with very interesting characters. The compound eyes of the insect are also between the glass slips. These you will observe differ both in shape and figure from those given in your last plate.

I also send you four species of cimices, according to the arrangement of Linnæus. But as the entomologists of the present day have made an alteration in his system, and constituted these species distinct genera, so I send these to you as such, presuming there is good and sufficient reason for the alteration being made. The first is the *Hydrometra Stagnorum,* a very singularly formed insect, found on the surface of the water, and furnished with a set of instruments within its rostrum, to extract the juices from aquatic plants. But the most singular appearance in this insect, is its having its compound eyes in the middle of its apparent neck. The second is *Miris vagans*; which you will find, on examining under your microscope, to be a very interesting object. The third is *Capsus spissicornis,* in this you will also find much to admire, particularly in its very curious antennæ. I met with these two specimens in Hornsey wood last summer. The fourth specimen is *Coreus rhomboideus,* a very beautiful insect, and extremely rare. I recollect taking a specimen some years since in Combe wood, and which was the only time, during many entomological excursions, that I ever met with it.

These four insects will afford your artist interesting subjects to make drawings from.

With the foregoing objects, you will likewise receive a section from the pith of a quill, in which are seen numberless minute pores, affording an interesting object when seen under the solar microscope; and also several fine specimens of cuttings, among which are sections from the stem and root of the stinging nettle. This despised plant, you will find, produces some of the most exquisitely finished workings of nature, when exhibited under the microscope: and when you have carefully examined these specimens, you will be delighted with the characters contained in their organization, and agree with me in acknowledging, that, "there is not a tree, a plant, a leaf, or a blossom; but contains a folio volume; we may read, and read again, and still find something new, something to please, and something to instruct the mind, e'en in the noisome weed!"

I remain, Dear Sir,
Your obliged friend,
To Thomas Gill, *Esq.* Thomas Carpenter.

References to the figures, and remarks. By the Editor.

In plate IV. fig. 1 is a highly magnified view of one of the flat jagged hairs of the caterpillar of the tussock moth; and fig. 2 is another, having also a tuft of hairs at its end, and a central hair terminating it. Fig. 3 is an under view of the sole of the foot of one of this caterpillar's legs, exhibiting numerous hooks or claws; and fig. 4 is a highly magnified representation of three of the claws, shown separately. Fig. 5 is a highly magnified representation of a group of six eyes, on one side the head of this caterpillar; but which, in the moth, become replaced by two compound eyes. And fig. 6 is one of the feathers of the wing of the moth highly magnified.

Fig 7 is one of the two piercing and cutting instruments, which, together with a pointed sucking-tube, constitute the three instruments found by Mr. T. Carpenter in the rostrum of a species of boat-fly. This highly magnified figure shows the outward end of this curious instrument to be sharp at its point for piercing, and serrated on one side of it, the serrations terminating in hairs. The other side of the instrument is made sharp like a knife, for cutting with; but which knife is afterwards serrated or toothed like a saw; and thus this singular instrument comprises within itself a sharp point, a knife, and two saws, a wonderful combination indeed! and, no doubt, admirably fitted for the purposes indicated by Mr. T. Carpenter.

Fig. 8 is a magnified representation of one of the curiously marked wing-cases of another species of boat-fly,

Fig. 9 is a highly magnified representation of the neck and thorax of the *Hydrometra stagnorum,* intended to show the singular position of its two compound eyes upon its neck. Its abdomen, antennæ, rostrum, and legs, are so long, that it was found impossible to introduce them into the plate.

Fig. 10 is a magnified representation of the head and curious antennæ of the *Capsus spissicornis.*

The specimens of wood cuttings, mentioned in Mr. T. Carpenter's letter, were made by the late celebrated Mr. Custance: and the Editor has many similar ones in his own collection of transparent microscopic objects. They are fully entitled to the encomiums passed upon them by Mr. T. Carpenter; and it is much to be regretted that no one has ever since been able to equal Mr. Custance's cuttings. He seems to have possessed methods, peculiar to himself, in the formation of his machine; and possibly, also, in the manner of preparing his woods for cutting.

XXXIV.—*On freeing Leaden Conduit Pipes from Air.*

By Mr. Daniel Treadwell, *Engineer, U. S.* *.

WITH A FIGURE.

A leaden pipe, having a bore an inch and a half in diameter, was laid from a well in Roxbury, to the mills at the water-works on the Boston mill-dam, for the purpose of supplying the workmen, who carry on the various manufactories erected on the mill-dam, and their families, with fresh water. The surface of the water in the well was found, by a survey, to be somewhat higher than any of the ground through which the aqueduct passed. The whole length of the aqueduct was about 6000 feet, and its general course was through a salt-marsh; in its way, however, it passed under two creeks, which may be taken at twelve feet deep each; and, near its termination, it descended from the marsh to the bed of the bay, on which the mill-dam is built. It was laid about three feet beneath the surface of the marsh, and opened into a reservoir at the city mills, four feet below the level of the surface of the water in the fountain well.

After completing the aqueduct, and opening it into the well, it was found that not a drop of water would run through it. As it was known that there were no mechanical obstructions in the pipe, it was thought not a little singular that the water should not pass through it.

In this state of things, I was requested, by those interested in the aqueduct, to consider the subject, and endeavour to procure the passage of the water. When the exact circumstances of the aqueduct were taken into consideration, I perceived that the water let into it might have such an arrangement in relation to the air with which the pipe was previously filled, as wholly to obstruct its passage. For, let us suppose A B in fig. 11 of plate IV. to represent a pipe, open throughout its length, perfectly air and water tight; and also having the several vertical flexures represented; and let it be required to pass water through it in the direction from A to B; the end *a* being elevated the height *a b;* and let *c d* be a horizontal line. It is evident that the water, on being let into the end at *a*, will pass and fill the pipe to *e*, displacing all the air with which the pipe, it being open to the atmosphere at its other end, was previously full. Then, flowing over the curvature *e* in a stream, less than the bore of the pipe, it fills the curvature at *f*, but without displacing the air previously contained in the descending part from *e* to *f*. This air is thus shut up, and cannot pass out of the pipe in any direction; unless, indeed, by passing under the water, but which, from its inferior specific gravity, is impossible. The water, continuing to flow over the flexure *e*, rises from *f* to *g*; and flowing over this flexure, the same thing is repeated, as to the air, from *g* to *h*, which took place in the flexures *e* and *f*. Thence, rising from *h*, until it attains some point, *i* for example, at which the sum of the perpendicular heights of the ascending columns A *e*, *f g*, &c. is equal to the column *a b*. That is, if we suppose the air to be inelastic, and void of weight; but, as this is not true, in fact, so the air will be condensed in a greater or less degree, according to its volume, and the height of the columns of water opposed to it. In consequence of this condensation, the water will rise, as shown in the figure, to *k* and *m* for example; and the weight of these columns being added to the effective force of the column *a b*, produces a rise of the water to some point, *n* for example, in the flexure *h n*. There is then a perfect equilibrium in the opposing forces, and the water can flow no farther. This equilibrium may be expressed generally, by

---

* From *The Boston Journal of Science.*

$$ab + cd = be$$

in which, *a* is the perpendicular height of the water in all the descending flexures; *b*, its density; *c*, the perpendicular height of all the enclosed air; *d*, its mean density; and *e*, the perpendicular height of all the ascending columns of water.

Several writers on hydrodynamics have noticed the obstruction which air often presents to the passage of water through bent tubes. But in the works that I have had an opportunity of consulting, the authors appear to regard the air as collecting in the higher parts of the tubes, and partially closing their bores, and thus diminishing, but without totally obstructing, the discharge of the water. Now this is quite different from the effect of the arrangement which I have attempted to explain. Those, however, who are acquainted with this subject, will recollect the Zurich machine for raising water, invented many years since, as owing its efficacy to an arrangement which the air and the water assumed in a spiral tube, and indeed very similar to that above stated.

As the aqueduct was more or less bent throughout its whole course to the mill-dam; and the two flexures were considerable, where it passed under the water in the creeks; so it appeared to me certain, that it was partly filled with air; and that this alone interrupted the flow of the water. On opening small holes into it, in several places, the air rushed out in great quantities; still, however, the water did not flow into the reservoir; and as it was impossible to get at the bendings, in every part of the pipe, without the labour of wholly uncovering it; so the design, of freeing it from air, by piercing it with small holes, was suspended. A force-pump was then connected to the upper end of the pipe, and water which had been heated in the worm-tub of a distillery in the vicinity, was forced into it. The pump was furnished with a valve, loaded with a weight, equal to a column of water eighty feet high; and a very small opening was made from the pipe of the aqueduct into the reservoir at the mills; so that the water, passing slowly through the whole length of the aqueduct, was there discharged. The object of this apparatus was to produce an absorption of the air, by bringing it into contact, under a heavy pressure, with water, which had parted with some of its air, by having been heated, as these conditions are known to be favourable to the absorption of air by water. The pumping was continued for about ten days, and the quantity of water used was nearly twenty hogsheads, when the pump was removed, and the aqueduct opened into the fountain well. The opening of the pipe into the reservoir being then enlarged, the water was found to flow into the reservoir, and discharged as much as was due to the head. This discharge has continued uninterruptedly to the present time, about five months. There can be no doubt but much air was absorbed, its presence in the aqueduct being indicated, when the pumping was commenced, by its throwing a stream of water out of the pipe on which the loaded valve was placed, whenever the weight was removed from the valve. The quantity of water thus thrown back, was much too great to have been produced either from the elasticity of the water, or that of the leaden pipe; and it diminished daily, having almost ceased before the pump was taken off.

Remarks. By the EDITOR.

Our readers will, no doubt, recollect the ingenious means employed by Mr. R. Cowen, of Carlisle, for freeing a leaden pipe, which acted as a syphon, in draining the water from a quarry, from the air contained in it, and for which the Society for the Encouragement of Arts, &c. &c. in the Adelphi, voted him their gold Vulcan medal, in the year 1827; and a re-publication of which, from the Transactions of the Society, together with a plate, will be found in our second volume, page 129.

Mr. Treadwell was already known to the Editor, from his having specified an English patent, obtained by him ten years since, for an Improved Printing Press; in which the power for producing the impression is derived from the weight of the pressman being employed in a very beneficial manner.

XXXV.—*On Preparations for Dyeing the Human Hair.*

By M. GENDRIN, *M. D.*[*]

THE formulas of the preparations for dyeing hair are numerous; they may, nevertheless, be reduced with respect to their mode of action, into two classes: the first, comprehends all those by which *iron* is caused to penetrate the hair in a determinate proportion; and which is afterwards changed *black* by the action of *gall-nuts.* The second comprises those formulas in which sulphur is employed, and made to penetrate the hair; and being afterwards susceptible of becoming black by combination with those substances which are black in the state of sulphurets.

To the first kind belongs the following formula, which is given by Forestus.

Take: red wine, one *livre*;
muriate of soda, one *gros*;
sulphate of iron, two *gros*;
Boil them for some minutes, and then add,
oxide of copper, one *gros*.
Make them boil for two minutes, withdraw them from the fire, and add,
pulverised gall-nuts, two *gros*.

The hair and beard must be well rubbed over with this composition, and some moments afterwards with a warmed linen cloth, and then be washed with common water.

The following formulas are of the second species:

Take: oxide of lead, two parts;
slaked lime, one part;
chalk, two parts:
Mix them with water, and dip a hair-pencil or brush into the preparation, with which the hair must be well rubbed; and at the end of two hours it must be washed, and the effect will be produced.

This last formula is the most generally employed, and is exempt from any inconvenience. Notwithstanding all that has been published against the practice of dyeing the hair, yet a great number of persons have recourse to it, and without experiencing the least accident. In this preparation there is produced a black sulphuret of lead, which is combined with the hair. The lime, when diluted by the chalk, loses that causticity which rendered it noxious.

---

[*] From "*L'Indust.*" or *Revue des Pays Bas.* 1829.

We likewise frequently employ the following preparation, which is more active.

Take: quick-lime, in the stone, one *livre*;
yellow litharge;
white lead, of each one ounce.

Dissolve the lime in water, and add, by degrees, and constantly stirring all the while, the oxides of lead.

There likewise belongs to these kinds of preparations another, but which possesses serious inconveniences: this is a mixture of lime and nitrate of silver. This mixture, which indeed blackens the hair, nevertheless produces an erysipelas on the skin, in which the hair is implanted; and its use ought, therefore, to be prohibited.

XXXVI.—*On a new method of colouring or ornamenting Steel. By M.* Leopold Nobili, *of Reggio, in Italy.*

This scientific gentleman was recommended to the notice of the Editor by Professor Babbage, in the beginning of the present year, as a philosopher who had much enriched galvanism by his inquiries. He brought with him several beautiful specimens of his new *Métallochromie*, or plates of steel, ornamented with regularly disposed spots, coloured of a greenish-yellow, blue, yellow, and other colours, graduated similarly to bright copper plates, when exposed to the action of heat. The backs of the steel plates were of an uniform brown colour, thus proving that these beautiful graduated tints had been produced at a degree of heat less than that required to give brightened steel a purple colour.

In the "*Bullet. de la Soc. d'Encourag.*" for January, 1829, is contained a report, made by M. Gualthier de Claubry, a member of that society, as follows:

"A learned foreigner, known by his ingenious researches, M. Leopold Nobili, having presented to this society the results of his experiments relative to a new art, to which he has given the name of *métallochromie;* you charged your committee of the chemical arts to examine these products; and I have, in its name, to report thereon.

"A great number of experiments, more or less successful, have been made by various persons, and at different periods, to apply, in a solid manner, paintings upon metals; but the solidity of the pictures did not equal their wishes, and the thinness of the colours applied rendered their traces vague, and greatly diminished the sharpness and finish of the designs.

"M. Nobili has lately, by his assiduous researches, and the labour of many years, produced, by a process which he has not made known, designs upon various metals, in which the brilliancy of the colours, and the harmony of the tints, leave nothing to be desired; thus these colours possess none of the inconveniences above stated; and they are develloped upon the surface of the metals without being too thinly diffused; but are stable, and will not disappear unless by the application of a high red heat, which, by its action, would also destroy the surface of the metal as well as the chemical agents employed upon it.

"Nothing can be more brilliant and singular than the colours upon M. Nobili's plates, especially by day-light; and all his designs are executed with a fine taste, the regularity of their forms, and the sharpness of their outlines, being all that can be wished.

"M. Nobili has not merely manufactured these plates as objects of curiosity, but has mounted several, which have been singularly esteemed by amateurs; and we can readily believe that this pleasing art would meet with great success were it carried into effect on a proper scale; and it is therefore much to be desired that so new and curious an art should not be lost to France, and especially as M. Nobili appears disposed to bring it into practice. We can easily form a just idea of the extent to which it might be possible to carry this branch of manufacture, when we remark that many metals assume their colours in very different orders by the application of heat; and we can easily conceive, that in the hands of a skilful man, and one well conversant with commerce, the greatest advantages might be derived from the employment of this new branch of industry. Thus, for instance, nothing presents more harmony than gold, as its tints are very different from those afforded by heating steel. It is upon this last metal that all the designs presented by M. Nobili have been executed. Silver likewise affords different colours on applying heat; and an experienced artist cannot fail to make many fine applications of M. Nobili's process.

" This process not being exactly known, many persons have accordingly formed suppositions, and even made experiments respecting it; but it does not appear that their suppositions have been well founded; and their success has been much less happy, and their colours less perfectly developed upon the surface of the metal, than can be effected by an art which has acquired perfection in the hands of M. Nobili:

" Under the impossibility, then, of being able to speak positively as to the manner in which M. Nobili has been able to produce these curious effects; we can only applaud the incessant efforts which he must have made to bring his art into the perfect state in which we find it. All those who have attempted new branches of manufactures, may well conceive the difficulties which every day presents, and which can only be overcome by a continued zeal and efforts to surmount unsuccessful endeavours; and M. Nobili could not otherwise have arrived at the point of perfection to which he has brought his *métallochromie,* nor can he be too much praised for the success he has obtained.

" We again repeat, that it is much to be desired that so curious an art should not be lost to France; and the Committee of Chemical Arts, in order to forward this object, have charged me to propose, that M. Nobili be recompensed for his interesting communication, by inserting this Report in the *Bulletin* of the Society."

XXXVII—*On Colouring Gold Works Yellow, with some Experiments on Gilding Bronze.* By F. P. Castellani *.

Experience has shown the author, that gold may be perfectly coloured, in a very short time, in a very simple manner, and with an uniform result, by certain liquids containing a solution of gold, and other saline and acid substances; owing to the chemical action, which, according to the opinion of the late Sir H. Davy, is exercised in the direct ratio of the chemical state of the substances exposed to it. It is then easy to perceive that this condition of the elements which compose the bath, contributes to oppose a too rapid electric action; and thus the precipitation of the gold is effected in a regular and perfect manner. Laying aside the task of exposing the theoretic ideas of the author, we shall proceed to make known his processes:

Of all the liquids proper for colouring gold, the two following appear to be the best.

First Mixture.

Hydrochloric acid at twenty-two degrees	10	grains
Sulphuric acid of commerce	4	
Crystallized boric acid	2	
Pure water	150	

Second Mixture.

Acid hydrochlorate of liquid alumina	13	grains
Crystallized sulphate of soda	4	
Crystallized boric acid	3	
Water	150	

---

* From the *Giorn. Arcadico*; 1826.

Into either of these mixtures must be put twenty grains of a neutral solution of hydrochlorate of gold, in order to form excellent baths for giving to gold a yellow colour. The following is the manner of operating.

M. Castellani employs a furnace, somewhat like that used to roast coffee; a circle of iron, with three feet to it, is enclosed in the sides of this furnace, upon which is placed a matras having a very large mouth; and as its lower part is intended to come into contact with the fire, so it should be well defended with lute. All being thus disposed, we pour into the matras the solution of gold, and when it has just attained the boiling point, we plunge into it the different pieces of gold-work, by means of a wire of gold; these pieces of work must have previously been well cleansed, in the usual manner. At the end of some minutes after their immersion, we plunge in a copper wire, and which must remain until we perceive that the gold begins to assume a dark tint. We must then withdraw the copper wire, and leave the articles in the liquor, until they have acquired the yellow colour desired. We then plunge them into warm water, acidulated either by the sulphuric or acetic acids, in order to dissolve any particles of oxide of copper which may possibly adhere to them; they are lastly to be washed in warm water, and well dried by placing them near to a charcoal fire,

Generally a single operation is not sufficient to produce the desired colour, and as a long continued immersion would be injurious, on account of the oxide of copper which is produced; so it is much better to repeat the process, until we have obtained the desired colour. In general, it is better to effect the colouring by many repetitions, in order to have it fine; as if the immersion be too long prolonged, the pieces become red, and must be cleansed anew, and submitted to new operations.

These mixtures are employed for those gold-works which contain a fourth of their weight of copper; but it is probable, that the proportions of the principal constituents of these liquids may require altering, according to the quantity of copper in other alloys. And we may add, that the immersion of the pieces of gold-work may be continued longer as they are more bulky or thicker; but the time must be shortened, when they are small, thin, or formed of wire, &c. When the bath which contains the gold in solution is no longer good, or begins to become weak, after many colorations; we may either add some drops of the solution of gold, or in case they may be required, some portions of the other constituents of the liquid. When the copper wire is found to be covered with a little metallic gold, it must be changed for another, in order that it may exert its electric action. If you would obtain an intense yellow colour, you must repeat the immersions, and the contact of the copper, many times; but if only a pale colour be required, it is sufficient, after the last immersion, to boil it, without touching it with the copper wire.

Bronze experienced the same effect as gold, after it had been coated with an amalgam of gold, and the mercury had been driven off by heating it. But the gold received a disagreeable and unequal yellowish-white tint; the author blames the mixtures employed, in which there was much sulphate of copper, which, as M. Ribaucourt has observed, will never answer. He therefore proposed to adopt a mixture containing a salt of gold, nearly similar to the two preceding ones; and after some experiments which he has made, he is led to conclude that they will be attended with good results. But, as his experiments are not yet concluded, it is out of our power to describe his process, or to give recipes for the mixtures.

XXXVIII.—*On the Manufacture of Coloured Foils* *.

THESE are employed by being placed underneath the precious or artificial stones, in order to increase their brilliancy; they likewise serve for decorating works in paper or pasteboard, and for a thousand other pleasing uses. We may easily perceive that those works are become much more perfect since we have been able to colour the surfaces of these foils, and to preserve the brilliancy of their polish, than when they were merely used in their natural state. The experiments made have been crowned with success, and a new art has been in consequence created. The original inventors, indeed, kept their process for tinting the foils a secret; and for a long time it was unknown. This art is now considerably extended, and even improved. As it has not, however, hitherto been described, we shall now endeavour to supply this deficiency.

---

* From the *Dictionnaire Technologique.*

When we have stated, that we employ varnishes in this manufacture, it is easy to perceive that they must be calculated to serve as coloured varnishes. We first cover the foils or leaves of metal with a tint of varnish, and then with another transparent varnish, which may preserve the colours from the attacks of humidity, and likewise contribute, together with the metallic brilliancy of the foils, to produce those fine effects which our customers require. We can vary the processes, according to the tones or shades of the colours; and it is easy to render them deeper or lighter.—The following is the ordinary process employed:

First preparation. We steep, for twenty-four hours, isinglass in very limpid water; and then expose it to the action of boiling-water, in a water-bath, in order to effect the solution of the gelatine. We pass the whole through a double linen cloth, or a piece of swan-skin, and evaporate it until the solution of gelatine assumes the form of a trembling jelly, after having been placed for two or three hours in a cool cellar.

Second preparation. We polish the metallic leaves of silver, copper, or brass, which we would colour, and then dip them, one after the other, as we proceed, in a weak *aqua-fortis*, formed of one part of nitric acid, diluted with from eight to ten or twelve parts of water. This immersion cleanses the metal, and renders it of a lively appearance;

and *instantly afterwards*, we pass the heated gelatine over it with a hair-pencil, and let it dry, in order to receive any colour we may desire, and which is effected as follows:

Blue. We put into a small mattrass, or an apothecary's phial, an ounce of fine prussiate of iron (prussian blue) reduced to powder, upon which we pour two ounces of hydrochloric acid. The mixture effervesces, and the prussiate is not long in assuming the consistence of a liquid paste. We suffer it to remain twenty-four hours; we then dilute it with nine ounces of water, and preserve the colour thus diluted in a well stopped bottle. This colour is deep; but we can readily lesson its intensity according to our wish, by adding a new quantity of water.

The leaves of silver, or of copper-silvered, are better than those of brass, for foils of this colour.

Another Blue. We take one part of fine guatimala indigo, and two parts of sulphuric acid, and put them into an apothecary's phial, placed in a sand-heat. An effervescence will take place; when this has subsided, we add ten or twelve parts of limpid water to it. This colour likewise is sufficiently intense to receive a large addition of water. It may be applied like the preceding, upon silver or copper-silvered foils.

Green. We can prepare this colour in two different ways; namely, either by mixing a decoction of the yellow of Avignon, with a little of either of the blues above described; or by employing a solution of the acetate of copper (distilled verdigris); these will afford greens of different natures.

Red. First, we can extract from cochineal a red approaching to purple; and we can vary this red by the addition of more or less water.

Secondly, we obtain another tint of red with a decoction of sandal-wood in alcohol, the great volatility of which furnishes a very simple means of concentrating the colouring part more or less. We can also procure another tint by the intermediation of water, which we afterwards evaporate, and thus obtain another extract, after the operation of the alcohol. This last process is, however, more tedious and expensive.

Thirdly, we can obtain another tint of red, from the *safranum.* We dissolve this colouring material in a solution of crystallized carbonate of soda, precipitate it with citric acid, and suffer it to dry. When it is completely dry, we dissolve it in alcohol. We can extend this colour, in successive layers, upon the metallic plates.

Violet. We extract the tincture of litmus with alcohol, and thus obtain a deep violet, which we can lighten at pleasure, by a larger quantity of alcohol. This is to be applied in a similar manner to the preceding.

Lilac. We enclose the litmus in a cloth tied up close, and steep it in water, as long as it will afford a rose colour; we then boil it in a new quantity of water, in which will be diffused the remaining colour; and can apply this decoction, when cold, and diluted to a convenient tint, upon the surfaces of the prepared metallic plates.

Ruby. We heat carmine, or which is still better, carmine lake, in water; and when the decoction has boiled, we add drops of liquid ammonia to it. We suffer the liquid to settle, in the cold, and then pass it over the metallic plates, without filtering it.

Rose. There are many ways of procuring rose colours. First; we add to the *ruby* colour a sufficient quantity of water to reduce it to the tint we desire.

Secondly, the *safranum* affords, by diluting its colour, rose colours of various tints.

Thirdly, a decoction of brazil wood, revived by the addition of a solution of tin in the hydrochloro-nitric acid, affords various tints of rose colour.

Scarlet or Poppy colours. We first spread, for the poppy colour, a layer of the *ruby* colour, and over this, a second coat of the tincture of the oriental *safranum,* extracted by macerating it in cold water for forty-eight hours.

The *Capucine*, the *Aurora*, the *Jonquille*, and certain other yellow colours, may also be obtained by treating the oriental *safranum* in the above manner, and which will afford colours more or less deep.

Plumb or other *Browns.* Apply a coat of lilac colour, and over that another of green or blue.

General Observations. We must never apply a second or third coat of colour, until the preceding ones shall have become perfectly dry. We must always avoid passing many times over the same spot, as the new layer, however cold, disturbs the preceding ones. And thus it is always advantageous to give the colour-bath a tint sufficiently deep, in order to dispense with the necessity of passing it repeatedly over the surfaces.

These various tints, however, do not yet possess the solidity they ought to have; as they may easily be removed by the effect of rain, or even of a mist; and can only be preserved from their action, by covering them with a defensive varnish. That, which has generally been applied to this kind of manufacture, is *the white alcoholic drying varnish.* But, if we would add to the solidity and better preservation of the tints, we should use *white copal varnish.* As this last, however, continues to diffuse a slight odour for some time, so we may cover it with a layer of *the white alcoholic varnish.* This species of manufacture, however, does not require a great degree of solidity to be given to it.

XXXIX.—*On Feeding Silk-worms, with the Leaves of the Scorzonera* *.

M. Turck, of Plombieres, having proposed the employment of the leaves of the Scorzonera, to rear silk-worms with, Mademoiselle Coge, of Epinal, was requested to try the experiment; the success was complete. The silk produced did not yield in excellence, to that produced by the worms fed upon mulberry leaves; and surpassed the specimens obtained from worms fed upon lettuce leaves.

---

* From the *Journ. de la Soc. d'émulation, du départ. des Vosges.*

This new food does not in the least degree derange the vital functions and habits of these insects. The quantity of silk obtained was at least double to that procured by employing the lettuce leaves; and the facility with which the plants of the Scorzonera can be raised, render it desirable that farther experiments should be made on this interesting subject.

XL.—*On the Great Works of the Bedford Level, in the Ely Fens. By the late* John Aikin, *M.D.**

If the majority of our summer tourists were asked what were their inducements, to visit one part of the kingdom rather than another? the only reason they could honestly give would be, " that other people did so ".

Curiosity, and the desire of change, lead them annually to spend a certain portion of their time and money in travelling; but the direction of these propensities is left entirely to the capricious Goddess of Fashion; and they would follow her as cheerfully to the moors of Cornwall, or the wolds of Yorkshire; as to the lakes of Westmoreland, or the mountains of Wales! There is, however, a numerous tribe, whose taste for that undefinable thing the picturesque, limits their rambles to the spots where that is to be found; and in their lists of places to be seen, they comprehend only those to which it is worth while to carry a portfolio. Others, again, with tastes more expanded, but still exclusive, can take delight in nothing but the sublime and beautiful of nature, and look with coldness on the creations of human art, or the ordinary variations of rural scenery.

But, surely, an enlarged and liberal curiosity, would scorn to be confined to any particular set of object; and would wish to extend its researches to every thing that the Creator has made, and that man has occupied! Independently of the purpose of storing the mind with useful knowledge, even amusement, the aim of persons of leisure, requires a large range for the pursuit of that novelty which is essential to its gratification; for nothing is more certain, than that a single set of objects, however splendid, will pall and become insipid by repetition. Perhaps, of all tastes, that for the mere picturesque soonest becomes tiresome; for when the most striking scenes of this class have been surveyed, nothing is left but inferior ones of the same kind, and disappointment and disgust succeed to rapture. I have not unfrequently known it to happen to travellers, in whom natural feeling was not stifled by pedantry and affectation, that, tired with wandering through a wild and romantic country, they have experienced undisguised pleasure, on emerging into a tame tract of cultivation, filled with " the smiling works of man ". Such a tract, but with many circumstances of singularity, that render it a novel spectacle to most British tourists, I now proceed to sketch.

---

* From his " *Athenæum.* "

The ISLE of ELY, comprehending the northern part of Cambridgeshire, is a considerable portion of that extensive tract of fen or low country, which stretches from the east of Huntingdonshire, to the west of Norfolk; and northwards, through the south-eastern division of Lincolnshire. The Cambridgeshire fens, strictly speaking, are not confined to the Isle of Ely; but spread, with the beds of the Ouse and the Cam, to a small distance from Cambridge. The isle, however, is emphatically the fenny part, and is chiefly separated from the rest of the country by the old channel of the Ouse, which river flows from the Huntingdonshire to the Norfolk border, and washes the city of Ely in its course.

The face of the country is one vast plain, stretching beyond the reach of sight; interrupted, on the southern side, by one or two ridges of comparatively high land; but, in all its northern portion, presenting only some small elevations, which just lift the villages seated upon them, above the general level. This whole tract is naturally a marsh, subject to be laid under water in rainy seasons, by the rivers which creep through it to the sea; and rendered habitable and cultivable only by means of immense labour, expended in cutting drains across it in various directions! Into these, the water is raised by means of wind-mills, which pump it up from the ditches that every where intersect the low grounds; and it is kept in by high banks, which confine it on a level, higher than that of the adjacent country. The most considerable of these works, consists of the Old and New Bedford Rivers, so called from the noble family of Bedford, who have given the name of the Bedford Level to the whole tract, which they were so instrumental in improving. These rivers, which completely cut across the Isle of Ely, make a communication from the Ouse at Earith, within the Huntingdonshire border, to the same river at Denversluice, near Downham, in Norfolk. They run almost perfectly straight and parallel, in the direction or N. N. E. for about twenty-one miles; leaving between them a space from two to six furlongs in breadth, called the wash; which is always under water in winter; but, in summer, is used as meadow and pasture land. The Old Bedford River is now scarcely employed for the purpose of navigation; but the New, or hundred-foot drain, is the main channel for vessels passing from the upper to the lower parts of the Ouse, and has superseded the passage along the natural river, which makes a large bend to the eastward of it. This artificial river receives the spring-tides as far as its origin at Earith, whence may be estimated the small elevation of the inland country above the surface of the sea. The Nen, which crosses the north-western part of the Isle, is in like manner led through an embanked channel. It communicates, by a navigable branch, with the Bedford river; and thus a system of navigation is formed, equally complete with that of drainage.

The fen banks afford a good horse-tract, and a view is presented from them, which, though at length tiresom from its uniformity, is not without its attractions. The water lies in a long reach before you, stretching beyond the sight; bordered, at intervals, with ozier beds (here called holts), and crowned with scattered houses and pumping-mills. Gangs of lighters, tracked by horses, and sometimes aided by sails, enliven the stream. The elevation of the banks, gives the traveller a very extensive prospect over the country; in which the dryer spots are marked by village steeples, and groups of trees; whilst in many parts, the eye wanders over a range of level green, varied only by herds of cattle, hay-stacks, and some detached farm buildings. Pollard willows sometimes border the ditches, that form the separation of lands, and relieve the general nakedness. The surface has all the varieties of rushy moor, grassy meadow, and cultivated field. The corn in the lower tracts, consists almost entirely of oats; while in the elevated parts all the species of grain are successfully grown. A common crop is cole-seed; which is raised both for the winter-feeding of sheep, and for the seed, whence oil is extracted. Mustard, flax, and hemp, are also among the articles of culture. In general, the drainage of the Ely fens is so complete, that it enables the land to produce whatever is most suitable to its soil; and much of it is exuberantly rich.

Among the objects presented by nature, the botanist will find a large variety of aquatic plants in great luxuriance; and the ornithologist will be entertained with a number of birds, not indeed equal to that of some of the unreclaimed fens of Lincolnshire, but sufficient to excite his attention. The heron is frequent by the sides of the drains, or in the watery plashes; and, by his tall stature, and wide spread wings, makes a principal feature among the feathered tribe. These places are also the resort of various kinds of gulls, with the tern or sea-swallow. The pewit or lapwing fills the moors with its clamour. Stares or starlings abound throughout the fens, and often collect in such flocks, as to form black clouds, hovering over the ground, and amusing the spectator by their continual change of form and appearance. The common birds of prey are kites and buzzards. In winter, a great variety of the duck kind, and other water-fowl, come up the washes, and offer a valuable capture to the fowler. Of the fish, pikes and eels are the most abundant; and in the spring season, smelts run up the Bedford river in great shoals.

It has been remarked, that where the energies of man are excited by circumstances of hardship or necessity, they generally proceed so far as to render his situation more abundant in conveniences than where indolence is favoured by the bounty of nature. This is the case with Holland, compared to the rest of Europe; and it appears to be that of the fens of Ely compared to some of the more desirable counties of England. The villages in this tract are for the most part well built, and have an air of comfort not usual in the common agricultural districts. That of Earith is even provided with a flagged foot-pavement for its whole length, a valuable accommodation in a low site, which cannot fail of being very wet and miry in the winter. The pale bricks and tiles, manufactured in these parts, give a very neat appearance to the houses; and the reed thatch of the barns and cottages, is extraordinarily warm and durable. Many of the churches are handsome, and have tall steeples, visible at a great distance—the landmarks of this naked tract. The cathedral of Ely, one of the largest and most remarkable edifices of the kind, is a conspicuous object, to a wide circumajacent country.

The inhabitants of the fens are chiefly engaged in farming, and many of the farmers are opulent. They feed numbers of cattle, and the sheep of the upland districts are frequently sent hither in the winter to fatten on the cole-seed. The brewing trade is considerable in several of the towns and villages; for the people are a thirsty tribe, and avail themselves of the excuse of a moist air, and bad water, to counteract the former, and correct the latter, by potations of as much strong beer as they can procure. In particular, those labourers who are employed in the important task of keeping the banks in repair (provincially termed *bankers)*, are as mighty to drink as to work. The natives in general, are a stout broad-set race, many of them with black hair and dark complexions. The population is scanty in proportion to the space of ground, and much of the harvest-work is done by Irish labourers. Few gentlemen of large estates reside in the fens, as the country is unfit for sporting, and certainly does not abound in rural beauty. The magistrates are principally the clergy, several of whom enjoy ample livings. The markets of the district are Cambridge, Ely, and Wisbeach.

Although trees are now scarce in the fens, and almost confined to willows and other aquatics, yet the bodies of oaks of large dimensions, still frequently dug up in the lowest and wettest tracts, prove that the country, at some remote period, was well wooded, and, probably, in great part a forest. As it is certain that before the drainage, a century and a half ago, it was more a morass than at present; conjecture is puzzled to determine at what remote era the soil could be capable of bearing timber-trees, where even now no one would think of planting them. Some of the trunks dug up are still serviceable wood. In the same parts very black turf or peat is cut, which is the common fuel. The oziers are an article of profit to the planters, from their sale to the basket-makers. The peeling of them after steeping in pits, is one of the occupations of the poor.

Such are the prominent features of a portion of this island, which, from its strongly marked character, and peculiar circumstances, is well worthy of being visited by all who travel for knowledge or amusement; though a long residence, or a repetition of visits, is more than can be claimed for it, except from those who are particularly interested in the objects it presents. To the sentimental surveyor it will afford a pleasure of a higher class than that which is merely taken in by the eye—the gratifying reflection that the powers bestowed upon man are adequate to procure him a comfortable existence, even where nature appears to have multiplied her difficulties and discouragements.

XLI.—*On Improvements in Bleaching. By Mr.* JUNIUS SMITH [*].

THE improvements made in the art of bleaching during the last half century, have, in some measure, conquered the prejudices inseparable from long established habits; and practical men, though strongly wedded to their own methods of working, and sufficiently jealous of projected improvements, have yielded reluctantly to a conviction of their utility. It is presumed, that the usual method of chemical bleaching, as now practised both in Europe and the United States of America, is too well known to require a particular description. In that method there appears to me to be a fundamental error in the alternate use of hot and cold liquors.

For, firstly, it is evident that a heated solution of alkali opens and expands the fibres of linen submitted to its action, and thus affords an opportunity for the alkali to act upon its colouring matter, and to increase its solubility. But the second step in the ordinary process of bleaching counteracts the first. The linen is taken hot from the bucking tub, and immediately thrown into cold water, for the purpose of being washed. The fibres of linen collapse, the colouring matter is condensed, and its affinity for the linen is restored, which is manifestly the reverse of the object intended to be gained by the process. If the rinsing water be of the same temperature as the alkaline liquor, this reaction is prevented.

Secondly, from this washing in cold water, the linen, after having been bucked a sufficient number of times, and exposed for months to the air in the fields, comes, in due course of time, to its second stage of operation.

---

[*] From *Silliman's American Journal.*

The linen, in large quantities, is immersed in vats of cold chloride of lime, in a quiescent state; and the bleaching properties of the liquor act upon it imperfectly and unequally, in consequence of the dense mass of linen, and the frigidity of the medium through which it has to act.

If the linen were put into the bleaching liquor moderately warmed, confined so as to prevent the escape of gaseous vapours, and then set into regular and constant motion, these objections would be obviated, and the effect of the warm liquor would be uniform and active, which can never be the case while it is cold, and in a state of rest.

What I have remarked concerning the manner of using alkaline and chloruretted liquors, applies with equal truth to the use of acidulated water, in the third stage of bleaching.

Thirdly. The third most important point to be considered in the process of bleaching, is the degree of heat to which the linen is subjected.

Bleachers are generally sensible of the advantages of heat, and various contrivances have been adopted to apply steam-heat to the purposes of bleaching. But I am not aware that any one has attempted to bring his goods into action in steam-heat under pressure. Nor do I know that there has ever been any mechanical invention brought into practice, by which it could be done, until my machine was constructed. The French bleachers have taken much pains to use an alkaline solution at a temperature above boiling heat, but without success. They indeed seem to have a correct idea of the probable effect of increments of heat above that degree; but failed in their attempts to reach it, through the imperfection of their mechanical inventions*. But I can find no evidence of their ever having conceived an idea of the advantages likely to result from the continued action of heat and motion.

Unless the steam is brought to act under pressure, it is evident that no material benefit is gained by steaming instead of boiling—often, indeed, the reverse; because the heat will never exceed, and the moment it is exposed to the atmospheric air, will fall below two hundred and twelve degrees of Fahrenheit, or the boiling heat. But if the steam is confined, it is easy to raise its heat to two hundred and fifty degrees; and then the effect upon the linen shows, in the most unequivocal manner, the advantages of augmenting heat in bleaching. This effect is not only more strikingly obvious, but is singularly beautiful, when the goods are also put into motion, and the degree of bleaching is rendered perfectly uniform.

---

* See Berthollet on Dyeing.

There can be no danger, as some have apprehended, of injuring the linen by excessive steam-heat, because the scorching heat of steam is five hundred and twenty degrees of Fahrenheit. A pressure of fifty atmospheres, or seven hundred and thirty-five pounds upon a square inch; a pressure, which no ordinary steam apparatus will resist.

Steam-heat, at three hundred and fifty degrees, thermometrical measurement, will so far soften soldering, as to cause it to yield to the pressure, and the steam-pipes will burst. These are facts, which I state as the result of my repeated experiments, in which I cannot be materially mistaken; and therefore I feel justified in saying, that it is not possible, with any ordinary working apparatus, to carry steam to so high a temperature, as to injure any goods submitted to its action. By giving motion to the linen, under the reciprocal action of steam-heat, under pressure, and in an alkaline liquor, the effect is not only more powerful, than it can be by bucking, but, as already hinted, it is more uniform. Every part of the cloth is equally exposed to the operation; and the colouring matter, detached from the cloth, floats in the liquor below.

This appears to me to determine the question, which some have raised, whether the colouring matter of linen is actually detached from the cloth; or is bleached upon it, without being detached? When we find that the loss of weight, in the various methods of bleaching, ranges from twenty to thirty per cent; and when we find the colouring matter suspended in the liquor, and reducible by evaporation to a mucus; it seems to me, that there can be no doubt, that the colouring matter is removed, or at any rate, a large proportion of it. The repeated experiments which I have made, upon a considerable scale, in bleaching, clearly demonstrate the utility of combining heat and motion. Their action is direct and uniform. The strong affinity, which unites the colouring, the mucilaginous, and the oleaginous matters with the fibres of the linen, is weakened, and rapidly overcome; and no opportunity is afforded for their subsequent combination.

By this method I have bleached Scotch drills in twelve hours, and Manchester cotton shirtings in four. There will be no occasion to croft cotton goods; but linens receive a clearer and more brilliant white, by exposure upon the grass for a few days.

The saving of alkali, by this method of bleaching, compared with the usual consumption by the English, Scotch, and Irish bleachers, is about twenty-five per cent!

To Professor SILLIMAN. JUNIUS SMITH.

XLII.—*On the uses and Improvement of Cast-Iron, &c.*

By Mr. DANIEL TREADWELL, *Engineer. U. S*[*].

THE extensive use now made of cast-iron, and that for purposes to which, but a few years ago, it was not thought of applying it, renders every investigation of its properties, and the modes of manufacturing it, important. This material, instead of being now confined in its use to a few culinary vessels, and coarse implements, is not only used, to the exclusion of almost every thing else, for machinery, but houses, bridges, roads, and even vessels have been constructed of it! Circumstances in England no doubt favour this extensive use, much more than they do in this country (the United States). Coal, and iron ore, are there abundant; and wood is scarce and dear. While, in New England, we have no good mineral coal, and our forests of timber are yet extensive.

---

[*] From *The Boston Journal of Science*.

The use of cast-iron for machines has, however, become very general in this country. Without it, the inventions of the present age could never have been carried into effect. A machine constituted of wood, subject to constant swelling and shrinking, and warping with every change of the atmosphere, is always liable to derangement. Indeed it can be said to be hardly capable of preserving its identity! While iron castings undergo no change of figure, and their trifling change of magnitude, by the variation of temperature, is a matter of small moment.

A great deal, however, yet remains to be done, to improve the quality of iron castings in this country. But the demand for them, such as they are, is yet too great, to expect the furnace-owners and iron-masters to give much attention to experiments for this purpose. The perpendicular mode of casting, is very far from being common, at the furnaces in this vicinity; although it undoubtedly possesses advantages which should lead to its universal adoption. The strength of a bar as has been ascertained by experiment, cast perpendicularly, being to that of one cast horizontally, as one thousand two hundred and eighteen, is to one thousand one hundred and sixty-six; while it is much less liable to air-bubbles, and imperfections of that kind, which render abortive the skill and calculations of the machinist. This superiority is not, as might be supposed from the terms employed, the effect of mere position, but of the pressure of the upright column; and if this is increased by a weight of extraneous metal, the casting is still more likely to be sound. This principle has even lately been carried to the extent, of compressing the fluid castings by mechanical means.

Cast-iron has usually been divided into three kinds; the white, grey, and black. But as these pass into each other, in every degree, so it often happens, that some castings do not bear the character of any one of the above kinds more than another. The white iron is hard and brittle; and it does not seem to be well understood to what this is to be attributed; while the black is soft and tender, and bears all the marks of containing too great a quantity of carbon. The grey iron, or gun-metal, as it is sometimes called, is superior for almost every purpose; it is sufficiently soft to yield to the file, and it is much stronger than either of the other kinds.

Cast-iron, when used in machines, or for buildings, should never be subjected to a weight or pressure which will produce a permanent alteration of its figure, or a set, as it is called by the workmen. As this can only take place from a change of the relation which the ultimate particles have to each other; small additions to a force, which is sufficient to produce this change, will be sufficient to increase it, until the relation is destroyed altogether. Although this may be taken as a principle, yet there is some limit in its application, depending on the shape and size of the bar, the kind of iron, and the direction of the the force. It seems true of some bodies, particularly of those of a crystalline or vitreous structure, that if strained, or if their particles are once separated beyond a certain point, the separation becomes complete. This point, corresponds with that of their power to recover their former relations or distances, or the elastic power of the body. In these, no permanent alteration of figure can be produced; for a fracture is the consequence of any force which destroys the elastic power. The hard kind of iron approaches this structure, and there is one considerable advantage in using it, which is, that it breaks immediately if it break at all. Whereas, with the softer kinds, which will bear a permanent alteration of figure, the fracture may not take place until the force has continued to operate some time. But if a force be applied to this iron, sufficient to produce such alteration, and be continued to operate some time. But if a force be applied to this iron, sufficient to produce such alteration, and be continued for a long time, or if the direction of it be continually changing, as is often the case in machines, a fracture will at length be the result. Much, however, depends on the shape of the bar, and the direction of the force, where that is constant. As, in a bar, to which the force is applied transversely; if the iron be soft, the particles can undergo some change in distance beyond their elastic force, without losing their cohesive attraction. In this case, those particles that are situated in the middle of the bar, do not undergo any strain, until the bar is somewhat curved; when an additional force is sustained by those particles, as this curvation is produced, and before the particles situated outside are strained to the fracturing point. But in cases where the direction of the fracture must be at a right angle to the direction of the force, the principle first stated, namely, that the force applied should not be sufficient to produce a permanent change of figure, may be taken as true. This indeed seems like going too much into the dark abyss of ultimate atoms; but as the facts above stated will be acknowledged so we hope to be excused for the manner in which we have connected them.

In forming iron castings to bear a transverse strain, it is common to increase their depth to several times their breadth; it having been generally understood, that the strength is as the square of the depth multiplied into the breadth. But, by the experiments of the late celebrated Mr. Rennie (Phil. Trans. part I, 1828), this rule was not found to hold in a bar of the depth of four inches, and the breadth of a quarter of an inch, although it held nearly up to this proportion; and that gentlemen thinks it evident, that the system of deepening has been carried nearly to its limits.

Experiments on the absolute strength of cast-iron have been made by several individuals, philosophers as well as engineers. Those of Mr. Rennie, above-mentioned, are deserving of considerable attention. Mr. Rennie's experiments were made with an apparatus well calculated to give correct results. They show the power of iron to resist compression; its power to resist a twisting force; and its tenacity, when the force is applied to the bars in the direction of their axis, and when applied at right-angles to that direction.

His experiments to find the power of iron in resisting compression, gave the following results. Cubes, of one-eighth of an inch, taken from the middle of a large block, were crushed with a weight of 1440lbs. And, what may seem somewhat anomalous, in several trials on specimens having the same area as the preceding, but an increased height, the force required to crush them was increased. Cubes of one quarter of an inch, were not crushed with a force less than 10,351 lbs. on an average; as might be expected, the power of resistance is not as the area, but advances by a more rapid progression.

Mr. Rennie relates but two experiments on cast-iron to ascertain its power to sustain weight when directly suspended from the ends of bars. These were made with bars of one quarter of an inch area, and gave a mean of 1193 lbs. equal to 19,088 lbs. per inch. By the experiment of Mushenbroëk, a bar of one inch area, will sustain 63,286 lbs. Mr. Rennie found that bars of one quarter of an inch square, having one end fixed in a vice, and a lever thre feet in length, applied in a proper manner to twist them were capable of sustaining about 9 lbs. on the end of th lever. His experiments on the strength of bars to resist [illegible] force applied transversely, gave the following results. [illegible] bar, one inch square, with supports 2 feet 8 inches apart broke under a weight of 1086 lbs. With the supports on foot four inches apart, a bar of the same size broke unde 2320 lbs. A bar two inches deep, half an inch thick, an two feet eight inches long, broke with 2185 lbs.; and wit the supports one foot four inches apart, it was again broke with 4508 lbs. Triangular prisms, a cross section of which contained the same area as the foregoing pieces, were fractured with 1437 lbs. when one of the angles was placed uppermost, and with 840 lbs. when the angle was downwards, the supports in both cases being two feet eight inches distant. Bars, three inches deep, and one-third of an inch thick; and four inches deep, and one quarter of an inch thick, required weights of 3588 lbs. and 3979 lbs. respectively, to fracture them, when the supports were two feet eight inches apart. Such are the experiments of Mr. Rennie. He also repeated the paradoxical experiment of Emerson, and found it true; that in triangular prisms, where the force is intended to act on one of the sides, the prism becomes stronger by having the portion containing its opposite angle cut away; that is, a part is stronger than the whole!

We shall end this paper by a statement of the comparative power of a few different metals to sustain weights by suspension, according to Mr. Rennie's experiments: all his bars being one quarter of an inch square:

A cast-iron bar, horizontal, sustained	1166 lbs.
A ditto, vertical	1218
A cast-steel bar, previously tilted	8391
A blister-steel bar, reduced by hammering	8322
A shear-steel bar, ditto	7977
A Swedish iron ditto, ditto	4504
An English iron ditto, ditto	3492
A hard gun-metal bar	2273
A wrought-copper bar	2112
A cast-copper ditto	1192
A fine yellow brass bar	1123
A cast tin bar	296
A cast lead bar	114

XLIII.—*On the Employment of Iodine, and a Triple Acetate of Lime and Copper, in Dyeing, &c.*[*].

It appears, from a note by Pelletier, that he ascertained, during a recent visit to England, that a large quantity of perioduret of mercury is sold in that country under the name of *English vermillion,* which is employed, principally, in the preparation of paper-hangings. Learning, also, that iodine was used in calico-printing, he analyzed a specimen of the colouring material from Glasgow, and succeeded in forming a compound, which was a perfect imitation of the English one. The proportions which he found to succeed best, were the following:

Hydriodate of potash	65
Iodate of potash.	2
Ioduret of mercury	33

This salt appeared to have cost, in England, one hundred francs the kilogramme (2 lbs. 3 oz.); but could be prepared in France for thirty-six francs, reckoning the iodine to cost forty francs.

"It appears to me (observes this skilful chemist), that this salt ought to be applied to the cloth before it is passed through metallic solutions. Among the latter, those which give the most beautiful colours, are the solutions of lead and mercury. This salt may be applied with advantage to cloths, by the aid of a solution of starch, which becomes of a beautiful violet colour (a known effect of iodine and starch). The starch appears also to contribute to fix the salt on the cloth.

"There is another salt also much employed, it is said, in Glasgow, in calico-printing, which I ought also to mention, because it appears not to be much used in France. This is a triple acetate of lime and copper, prepared in the large way, by Ramsay, of Glasgow, for the printers. This salt is of a very beautiful blue colour. It crystallizes in prisms, with square bases. The summits of the prisms are, however, often replaced by facets, whence result prisms with six or eight planes, according to the extension which the secondary faces acquire.

---

[*] From the *Bulletin d'Encouragement.* 1828.

"When this salt is decomposed by a fixed alkali, the oxide of copper and the lime are precipitated combined, because they meet in the nascent state, and in definite proportions. It is certain that the precipitate turns but little green in the air, even in drying; and in its application it is a kind of verditer, which becomes fixed on the cloth. I call the attention of calico-printers to this salt, which may furnish very beautiful dyes, and cannot be very expensive."

XLIV.—*On the great Timber Slide, erected by* M. RUPP, *at Alpnach, on the lake of Lucerne. By Professor* PLAYFAIR.

ON the south side of Pilatus, a considerable mountain near Lucerne, are great forests of spruce-fir, consisting of the finest timber; but in a situation which the height, the steepness, and the ruggedness of the ground, seemed to render inaccessible. They had rarely been visited but by the chamois' hunters, and it was from them, indeed, that the first information concerning the size of the trees, and the extent of the forest, appears to have been received. These woods are in the canton of Underwalden, one of those in which the ancient spirit of the Swiss republics is the best preserved; where the manners are extremely simple, the occupations of the people mostly those of agriculture; where there are no manufactures, little accumulation of capital, and no commercial enterprise. In the possession of such masters, the lofty firs of Pilatus were likely to remain long the ornaments of their native mountains.

A few years ago, however, M. Rupp, a native of Wirtemberg, and a skilful engineer, in which profession he had been educated, indignant at the political changes effected in his own country, was induced to take refuge among a free people, and came to settle in the canton of Schwytz, on the opposite side of the lake of Lucerne. The accounts which he heard there of the forest just mentioned, determined him to visit it; and he was so struck by its appearance, that, long and rugged as the descent was, he conconceived the bold project of bringing down the trees, by no other force than their own weight, into the lake of Lucerne, from which the conveyance to the German Ocean was easy and expeditious. A more accurate survey of the ground convinced him of the practicability of the project.

He had by this time resided long enough in Switzerland to have his talents and integrity in such estimation, that he was able to prevail on a number of the proprietors to form a company, with a joint stock, to be laid out in the purchase of the forest, and in the construction of the road, along which it was intended that the trees should slide down into the lake of Lucerne, an arm of which fortunately approaches quite near to the bottom of the mountain. The sum required for this purpose was very considerable for that country, amounting to nine or ten thousand pounds; three thousand to be laid out on the purchase of the forest from the community of Alpnach, the proprietors of it, and the rest being necessary for the construction of the singular road or way by which the trees were to be brought down. In a country where there is little enterprise, few capitalists, and where he was himself a stranger, this was not the least difficult part of M. Rupp's undertaking.

The distance which the trees had to be conveyed is about three of the leagues of that country, or, more exactly, 46,000 feet. The medium height of the forest is about 2500 feet (which measure I took from General Pfyffer's model of the Alps, and not from any actual measurement of my own). The horizontal distance just mentioned, when reduced to English measure, making allowance for the Swiss foot, is 44,252 feet, eight English miles, and about three furlongs.

Along this line the trees descend, in a sort of trough, built in a cradle form, and extending from the forest to the edge of the lake. Three trees, squared, and laid side by side, form the bottom of the trough, the tree in the middle having its surface hollowed, so that a rill of water, received from distance to distance, over the side of the trough, may be conveyed along the bottom, and preserve it moist. Adjoining to the central part (of the trough), other trees, also squared, are laid parallel to the former, in such a manner as to form a trough, rounded in the interior, and of such dimensions as to allow the largest tree to lie, or to move along quite readily. When the direction of the trough turns, or has any bending, of which there are many, its sides are made higher and stronger, especially on the convex side, or that from which it bends, so as to provide against the trees bolting or flying out, which they sometimes do, in spite of every precaution. In general, the trough is from five to six feet wide at top, and from three to four in depth, varying, however, in different places, according to circumstances.

This singular road has been constructed at considerable expense; though, as it goes, almost for its whole length, through a forest, the materials of construction were at hand, and of small value. It contains, we are told, thirty thousand trees; it is, in general, supported on cross timbers, that are themselves supported by uprights fixed in the ground; and these cross timbers are sometimes close to the surface; they are occasionally under it, and sometimes elevated to a great height above it. It crosses in its way three great ravines, one at the height of sixty-four feet, another at the height of one hundred and three, and the third, where it goes along the face of a rock, at that of one hundred and fifty-seven; in two places it is conveyed under ground. It was finished in 1812.

The trees which descend by this conveyance are spruce firs, very straight, and of great size. All their branches are lopped off; they are stripped of their bark, and the surface, of course, made tolerably smooth. The trees or logs of which the trough is built, are dressed with the axe, but without much care.

All being thus prepared, the tree is launched, with the root end foremost, into the steep part of the trough, and, in a few seconds, acquires such a velocity, as enables it to reach the lake in the short space of six minutes; a result altogether astonishing, when it is considered that the distance is more than eight miles; that the average declivity is but one foot in seventeen, and that the route which the trees have to follow is often circuitous, and in some places almost horizontal!

Where large bodies are moved with such velocity as has now been described, and so tremendous a force of course produced, every thing had need to be done with the utmost regularity; every obstacle removed that can obstruct the motion, or that might suffer by so fearful a collision. Every thing, accordingly, with regard to launching off the trees, is directed by telegraphic signals. All along the slide men are placed, at different distances, from half a mile to three quarters or more, but so that every station may be seen from the next, both above and below. At each of these stations, also, is a telegraph, consisting of a large board like a door, that turns at its middle, on a horizontal axle. When the board is placed upright, it is seen from the two adjacent stations; when it is turned horizontally, or rather parallel to the surface of the ground, it is invisible from both. When the tree is launched from the top, a signal is made, by turning the board upright; the same is followed by the rest, and thus the information is conveyed, almost instantaneously, all along the slide, that a tree is now on its way. By and bye, to any one that is stationed on the side, even to those at a great distance, the same is announced by the roaring of the tree itself, which becomes always louder and louder; the tree comes in sight when it is perhaps half a mile distant, and in an instant after, shoots past, with the noise of thunder, and the rapidity of lightning! As soon as it has reached the bottom, the lowest telegraph is turned down, the signal passes along all the stations, and the workmen at the top are informed that the tree is arrived in safety. Another is set off as expeditiously as possible; the moment is announced as before, and the same process is repeated, till all the trees that have been got in readiness for that day have been sent down into the lake.

When a tree sticks by accident, or when it flies out, a signal is made from the nearest station, by half depressing the board; and the workmen from above and below come to assist in getting out the tree that has stuck, or correcting any thing that is wrong in the slide, from the springing of a beam in the slide; and thus the interruption to the work is rendered as short as possible.

We saw five trees come down; the place where we stood was near the lower end, and the declivity was inconsiderable (the bottom of the slide nearly resting on the surface), yet the trees passed with astonishing rapidity. The greatest of them was a spruce fir, a hundred feet long, four feet in diameter at the lower end, and one foot at the upper. The greatest trees are those that descend with the greatest rapidity; and the velocity, as well as the roaring, of this one was evidently greater than of the rest. A tree must be very large to descend at all in this manner; a tree, M. Rupp informed us, that was only half the dimensions of the preceding, and therefore only an eighth part of its weight, would not be able to make its way from the top to the bottom. One of the trees that we saw, broke by some accident into two; the lighter part stopped almost immediately, and the remaining part came to rest soon after. This is a valuable fact; it appears from it, that the friction is not in proportion to the weight, but becomes relatively less as the weight increases, contrary to the opinion that is generally received.

In viewing the descent of the trees, my nephew and I stood quite close to the edge of the trough, not being more interested about any thing, than to experience the impression which the near view of so singular an object must make on a spectator. The noise, the rapidity of the motion, the magnitude of the moving body, and the force with which it seemed to shake the trough as it passed, were altogether very formidable, and conveyed an idea of danger much greater than the reality! Our guide refused to partake of our amusement; he retreated behind a tree at some distance off, where he had the consolation to be assured by M. Rupp, that he was no safer than we were; as a tree, when it happened to bolt from the trough, would often cut the standing trees clear through! During the whole time the slide has existed, there have been three or four fatal accidents, and one instance was the consequence of excessive temerity.

I have mentioned that a provision was made to keep the bottom of the trough wet; this is a very useful precaution; the friction is greatly diminished, and the swiftness is greatly increased, by that means. In rainy weather the trees move much faster than in dry. We were assured, that when the trough was every where in its most perfect condition, the weather wet, and the trees very large, the descent was sometimes made in as short a time as three minutes!

The trees thus brought down into the lake of Lucerne are formed into rafts, and floated down the very rapid stream of the Reuss, by which the lake discharges its waters first into the Aar, and then into the Rhine. By this conveyance, which is all of it in streams of great rapidity, the trees sometimes reached Basle in a few days after they had left Lucerne; and there the immediate concern of the Alpnach company terminated. They still continued to be navigated down the Rhine in rafts to Holland, and were afloat in the German Ocean in less than a month from having descended from the side of Pilatus, a very inland mountain, not less than a thousand miles distant. The late Emperor of France had made a contract for all the timber thus brought down.

XLV.—*On the Preparation of Crayons, or Pastels* *.

Crayons are coloured pastes which artists use in making drawings, to which they give the name of "drawings in pastel." The best crayons come from Switzerland, and principally from Lausanne

As they cannot, in this species of dry painting, produce the different colours or shades necessary, by mixing the principal colours, or diluting them with white, as in other kinds of painting, they are obliged to have crayons of all colours and shades.

This kind of crayon results from the mixture of any colour with a colourless base, and the whole has the consistence of a soft paste given to it, by means of a weak mucilage. This paste is afterwards formed into small cylinders, and dried; but as it is indispensable that the crayons should readily extend upon the paper, and apply themselves in a smooth uniform layer, without any grittiness; so it results, that we cannot indifferently employ, for making them, every kind of colour, basis, or mucilage; as there are some colours which, in drying, acquire too great a degree of hardness, and which they communicate to all the crayons of which they should form a part; and there are others which are susceptible of becoming more coherent with one vehicle than with another. It is the same with the mucilages also, which might give too great a degree of hardness to one kind of paste, and too little to others. And we have therefore to make choice between them, and to vary their proportions, in order to form crayons which should possess all the requisite qualities.

We have before mentioned, that it is particularly necessary that the crayons should readily extend upon the paper, and in uniform layers; but these conditions cannot be fulfilled, unless the particles composing the paste be exceedingly minute, and be held but slightly together. And thus, the best means of separating the molecules, and giving them the requisite degree of minuteness, is by employing the method known by the term *levigation;* and which consists in adding to the bodies, previously reduced to a fine powder, a considerable quantity of water, and stirring the whole until it forms a uniform mixture; this must be suffered to remain a few moments at rest, and then be poured off. This will at length deposit, as we can readily conceive, a powder, which is much more subtle than the former one. In fact, as the molecules are larger, so they are heavier, and precipitate in much less time than the former or smaller ones. This method of proceeding equally applies to all the bases, as well as the colours. After this statement, we must add, that the most usual bases or excipients of the colours of crayons, are either washed chalk, or the white or tobacco-pipe clay; sometimes, indeed, but rarely, we also employ calcined gypsum, the oxide of bismuth, the sub-carbonate of lead, or ceruse, and also starch or flour. It is to be presumed, that the magnesian earths, which are ordinarily so soft to the touch, also offer some advantages in this respect; the bolar earths, and the ochres, which are nothing else than clays naturally coloured by the oxides of iron, may also be usefully employed in the preparation of crayons.

---

* From the *Dictionnaire Technologique*.

When we have selected that base which is most convenient to mix with the colour that we would employ, we must also seek for that species of mucilage to which we ought to give the preference; in order that the crayons, after being dried, should preserve the necessary degree of consistence; and here the only sure guide is experience; that is to say, we must make trials on a small scale, when we first begin to form this kind of composition. Thus, to bind these pastes, we usually employ the mucilage of gum arabic, or still better, that of gum tragacanth; but we must also make the mucilage more or less thick, according to our design; that is to say, that we must dissolve in the same quantity of water more or less gum. In general, the preference is given to gum tragacanth, because an equal weight of it furnishes a more abundant mucilage; and, consequently, there remains a less weight of it in the paste after dessiccation.

When the pastes require but a slight degree of agglutination, we add to the mucilage of the gum a little sugar, in order that it may acquire a less degree of hardness in drying; or we substitute for the mucilage, either a simple decoction of malt, or milk. Sometimes, also, the addition of a little soap-lees produces a good effect. Finally, we also incorporate with certain pastes, and principally those in which alumine forms a part, fatty bodies, such as oils, wax, or suet; and we even entirely replace the mucilages, or other viscous materials, by a mixture composed of sixteen parts of suet, four parts of wax, and one part of spermaceti. But we can only use these crayons upon canvas, or pasteboard, coated with oil-varnish, and dusted over either with powdered glass, or pumice-stone in powder; they are indeed more difficult to use, but then the pictures produced have more solidity than those made with the ordinary crayons.

After giving these general details, it now remains that we indicate the processes for the preparation of crayons or pastels. We commence by making what are termed the primitive pastes, and which are afterwards mixed with other ingredients in different proportions, in order to obtain all the required shades of colour. Thus, we grind in the usual manner, the colour which is to enter into the paste; we then add, by grinding, a sufficient quantity of the base, or excipient, to form a shade which may serve as a type or pattern, we then divide this into as many portions as we would obtain other shades, and incorporate with each, a progressively increasing quantity of the white base, or excipient. Thus, in the first portion we put, for instance, one part; in the second, two parts; &c. until we have formed all the gradations of tint we require. We may readily conceive, that this method equally applies to other colours mixed with the primitive ones, and that it is easy by this means, to obtain from them all, every colour, and of every requisite gradation.

It is easy to perceive that it would be inconvenient to dispose of a great number of these pastes at once, especially in summer, as the masses would dry at their surfaces, before they were formed into crayons, and thus produce lumps, which would mix but difficultly with the remainder of the paste, and thus render it gravelly. Supposing then, that we have only prepared a certain number, and that we would form them into crayons; we commence by drying the paste a little, between doubled unsized papers, and when the excess of humidity is thus absorbed, and the paste can be handled without adhering too much to the fingers, we divide it into small masses, which we first form into balls between the palms of the hands, and then roll them between the flat part of the right hand, with a backward and forward motion upon a well-dressed flat and smooth wooden plank; upon which are also affixed two small parallel rods or bars of an equal thickness, and which are placed at right-angles to the workman. The paste is thus formed into long cylinders, and when they begin to be of a diameter nearly equal to the thickness of the bars, in order to reduce them to the required thickness, we substitute a piece of flat and smooth wood for the hand, and whose length exceeds that of the width between the two rods, and is gradually tapered away at each end, so as to form handles. We continue this backward and forward movement until the piece of wood rests at each end upon the two rods. The cylinders thus acquire length, and it then only remains to divide them, by means of a knife, into the lengths which we would give to them. They are usually about two inches long. In order to cut them without flattening their ends, we should take care to apply the knife, whilst rolling the cylinders.

When we have taken care to press the paste well in rolling it, in order to drive out any particles of air which it enclosed, we shall obtain crayons which will break with a homogenous fracture; but if, on the contrary, we have neglected to take this precaution, they will be too fragile, and their fracture will be cavernous. In this case it will be difficult to use them upon paper, and we think that in order to obviate this inconvenience, and without being obliged to have recourse to a manipulation much longer than this we have described, the rolled paste might be strongly compressed between two channels which exactly correspond, and thus form a cylinder of the exact dimension we would give to the crayon. Others, on the contrary, employ a mandrel formed of polished brass, from eight to ten inches long, and slightly conical. They roll upon this mandrel a thin leaf of tin (tin-foil), and then take it off the mandrel; into this kind of mould they pour the paste, made a little more liquid than in the preceding case, and then leave it to dry slowly. When the crayon has become of a certain consistence, they remove the tin mould.

Amongst the crayons usually sold, and which we submitted to trial, we laid aside those which were not of a proper quality; thas is to say, those which were either too hard, or too fragile. We remedied the first fault, and which is usually occasioned by their containing too large a proportion of plaster of Paris, by again grinding up the crayon with a little milk and water, and then proceeding in the manner above indicated. And we obviated the second defect, which evidently proved the want of a binder, by adding a little to them, thus; we ground them up with a sufficient quantity of water, and then incorporated more or less clay with them, as was required.

We are obliged to take great care in avoiding the breaking of the crayons. Generally they are contained in flat boxes, where they are disposed in parallel rows upon cotton. Each colour, and its gradations, occupy distinct places, for the facility of using them *.

---

* We have before mentioned, that we sometimes employ fatty substances in making certain kinds of pastels or crayons. We find in an old Dictionary of the Arts, the following receipts. The first is due to a German painter, named Reifſtein; it consists in firſt reducing the colours, by grinding, to a very fine powder, and then incorporating this powder with a mixture of wax

We think that what we have above stated, might be sufficient to guide those, who have a sufficient knowledge of colours, and of their preparation ; nevertheless, we shall add thereto a certain number of receipts, or at least indications, which we find in the *Traité des Couleurs, by* M. I.—Ch. Leuchs.

White Crayons.

"1st. Pure chalk, well washed without any other preparation.

2nd. White-lead *(ceruse)* ground with milk, and dried in the shade; if they should not possess sufficient solidity, a little gum may be added to the milk.

"3rd. The white oxide of zinc, treated in the same manner. Or we may also use the sulphate of barytes, magnesia, or calcined bones."

We may observe with respect to the white from zinc, that it possesses a great advantage in not becoming black, as is the case with white lead, by exposure to sulphureous vapours. We can employ that oxide of zinc, which is known in commerce by the name of flowers of zinc; but, as it likewise always contains some grains of metal, so it is essential to commence by separating them, by mixing it

---

and suet. This mixture is to be ground up in a small vessel, exposed to a very gentle heat. When the mixture is become nearly cold, it must be cut into small portions, which are to be placed between double blotting paper, in order to absorb the excess of fat in the crayons, and thus to give them a consistence, when they are to be thrown into cold water. These crayons, as we before observed, can scarcely be used upon common paper.

We also find another receipt, given by a painter named Bachelier, who had found the means of preparing two kinds of crayons ; the one soft and tender, so as to be capable of extending between the fingers, and which might be fixed, by exposing the drawing made with them to a slight degree of heat, as is practised with the paintings in encaustic. He was not so sanguine as to the durability of the drawings made with the others. To prepare the first kind, he dissolved salt of tartar in warm water, to saturation ; he then filtered it through paper, placed it over a gentle fire, and dissolved white wax in it ; the result was, a kind of soap of wax, of the consistence of boullie, and very soluble in water. When he would prepare crayons, he dissolved a little of this soap, and used the solution to incorporate with the colours, and make a paste, which he cut and formed into small pastels, proper to make fixed drawings by afterwards heating them. To make them harder, he placed them under a muffle, and gave them a small degree of heat. We might make coloured drawings with these crayons ; which, according to the assertion of this artist, would not alter.

with water, and passing it through a sieve, placed over an earthen vessel; the oxide passes through the sieve, but the grains of metal are retained in it.

The sulphate of barytes is of too dry a nature to make good crayons. The calcined bones, which are, as we know, entirely composed of phosphate of lime, are likewise in the same predicament, though in a less degree; but it is possible to give this salt a different preparation, which renders it much more preferable for this purpose. We treat the calcined bones by the sulphuric acid, as in the process for making phosphorus; we then saturate the acid phosphate of lime, which we obtain by lixiviation, by means of the sub-carbonate of soda, which remains in solution; and the sub-phosphate of lime, which, being insoluble, is precipitated. We then wash it well with a large quantity of water, filter it, and obtain this new phosphate of lime, which no longer possesses the rigidity of the bones; but, on the contrary, has a great tenuity, and is of a fine dead white colour*. A slight calcination renders this white still more clear; but we must take care that the washing has been perfectly performed, otherwise, if any phosphate of soda remains in it, it will form a kind of *frit* of great hardness.

Yellow Crayons.

"1st. Natural ochre, ground up with more or less gum-water, and formed into crayons.

"2nd. Mineral yellow, Naples yellow, chrome yellow, or turbith mineral, either ground separately or with chalk, and gum-water, and put into form.

"3rd. Orange arsenic, treated in a similar manner. These crayons must not be employed with those made of white lead."

We can also obtain fine shades of yellow, by mixing, in various proportions, a solution of alum with solutions of iron, at different degrees of oxidation; then precipitating the whole by the sub-carbonate of soda, washing the precipitate, and either simply drying it, or submitting it to a calcination more or less great.

---

* Surely this preparation must form an excellent white colour for miniature painting.—EDITOR.

It is to be regretted that the *sulfure de cadmium* is so dear, as it is not only of a fine yellow colour, but, which is of more consequence, it is not, like the above, likely to change from exposure to vapours.

Red Crayons.

" 1st. Soft red chalk, red earth, or bole, either ground up with milk or gum-water.

" 2nd. Vermillion, brown red, chrome red, either singly, or mixed with white earths; and rendered solid by gum tragacanth.

" 3rd. Lakes of Brazil-wood, madder, or carmine, mixed with clay, and sometimes with starch; and rendered solid with the yeast of beer, milk, or gum-water.

Blue Crayons.

" 1st. Prussian blue, or indigo, ground with the decoction of malt.

" 2nd. Smalt, or cobalt blue, either singly or with chalk, and ground up with gum tragacanth water.

Green Crayons.

" 1st. Green earth and chalk, ground up with gum-water.

" 2nd. Brunswick green, or any other green colour from copper, ground up with gum-water.

" 3rd. Yellow and blue mixed.

Brown Crayons.

" Umber, single, or ground up with chalk, and gum-water.

Black Crayons.

" 1st. Willow charcoal.

" 2nd. Lamp-black calcined, with a little umber, indigo, and gum, or the decoction of malt."

We are obliged to M. Ferrand for communicating the following receipts, which he has put in practice with success, in his colour manufactory at Paris.

Blue Crayons.

As Prussian blue acquires too great a degree of hardness in drying, we can obviate this inconvenience in the following manner. We treat the Prussian blue, by heating it in concentrated sulphuric acid, and then adding a large quantity of water; the blue, which at first disappeared, is then reproduced, but in a perfect state of division. We suffer it to precipitate, and wash it well in several waters; then we add to the blue, in the state of a *bouillie*, a mixture of equal parts of chalk and magnesia, both of which had previously been properly prepared; and, finally, we wash it again once or twice, in order to remove a little sulphate of magnesia, which forms itself, as well as all the acid, which was not before entirely freed from it. We then drain it and dry it, and finally grind it up with a sufficient quantity of water to make a paste, which we form into rolls or cylinders, without adding any gum.

Red Crayons.

The carmine lakes, which contain much alumine, are subject to the same inconvenience as the Prussian blue; that is, they make crayons which are not soft enough. We obviate this defect in the following manner. We tinge with red the chalk of Champagne, mixed with a fourth part of magnesia; in order to do this, we employ cochineal, which we boil with a little alum; we then put this decoction, after straining it, into an earthen vessel; the alum is decomposed, and the alumine, on separating, entangles with it the colouring matter, and the liquor is found colourless. We repeat this process until the chalk is become sufficiently tinged, then dry it, and mould it in the usual manner. R

XLVI.—*On transferring Prints to the surface of Wood, and either Reversing them or not. And on making and applying hard White Spirit Varnish to it**.

THIS process is greatly analogous to that formerly employed in transferring prints to the surface of glass, and to the back of which prints colours were afterwards applied, so as, in some degree, to imitate oil-pictures. Here, however, they are applied upon the surface of wood, such as cornel, sycamore, horse-chesnut, satin-wood, *aer-wood,* or the curly veined maple, &c., which is afterwards to be varnished.

The wood having been planed smooth and even, is to have a slight coat of the best glue applied upon it; when this has become dry, it must be rubbed with Dutch rushes, or glass-paper, to remove the small filaments which the glue had raised, and render the surface uniform. We then apply a layer of white alcoholic varnish, taking care not to cross the marks left by the brush, and pass as few times as possible over the same place; it is then left to dry. We afterwards apply, in succession, three, four, five, or six other coats of varnish upon it, according as the varnish may be thinner or thicker.

The edges of the print are then to be cut close to the engraving; and it must be laid upon a proper table, with the impression downwards; it must be then uniformly moistened with a wet sponge, or in any other manner. When it has been equally and thoroughly wetted, it must be placed between two leaves of blotting-paper, in order to remove any drops of water. We then apply another coat of varnish over the surface of the wood; and, before it is become dry, apply the moistened print upon it, with the engraving downwards. In order to do this, we lay one edge of the print first upon the surface of the wood, holding it suspended by the other hand, and wipe successively over the back of the print, in such a manner as to drive out all the air, and prevent the formation of blisters. We then lay a sheet of dry paper upon it, and pass a linen cloth over evey part of the print, in order to fix it securely upon the varnish. We must take great care to place the print steadily upon the varnished wood, lest we may make a false or distorted impression of it. We then leave it to dry; and when it has become thoroughly dry, we moisten the back of the paper with a sponge, and pass or lightly rub the fingers backwards and forwards over it repeatedly, so as to remove the moistened paper in small rolls curled up. When, however, the marks of the paper begin to appear, we must take care lest, in rubbing, we should remove any portion of the paper upon which the impression is taken. When we find, therefore, that we can remove no more of the paper, without incurring the risk of injuring the print, we suffer it to dry; in drying, the engraving will entirely disappear at the back of the print, it remaining covered with a slight couch of paper. But, on again giving one coat of varnish, the paper will entirely disappear. It must then be again suffered to become quite dry. If by chance we have raised any small parts of the engraving, we must retouch those defects with fine lamp-black and gum-water, before we polish the varnish, as we have before-mentioned, and with great care, in laying on a second couch of varnish, that we pass rapidly over the retouched parts. When this last coat of varnish is become perfectly dry, we may remove any projecting part of the paper, and polish it with Dutch rushes, steeped for three or four days in olive oil; we then remove the oil by rubbing with a fine linen cloth, and sprinkle it all over with starch or hair-powder; this will absorb the least remains of the oil, and we remove it by first passing the palm of the hand over it, and then by carefully wiping or rubbing it with a fine linen cloth; we next apply three or four more layers of varnish, taking care to let it dry between each coat. When the last coat is become quite dry (in three or four days' time), we polish the varnish with a piece of fine woollen cloth, and chalk or whiting of the finest kind.

---

* From *Journ. de la Société du Bas. Rhin.* 1827.

In order to prepare this fine chalk, we must grind the ordinary chalk in a mortar, with a little water; and when it is well ground, we add more water, and pour it into a glass vessel, suffering it to remain at rest five or six minutes, it will then have deposited its coarser particles. We then decant the liquid, which holds in suspension the finer particles of the chalk; let it rest, and when the water has become clear, we pour it off, and shall find the sediment in the form of a *bouillie*, and which we use to polish the varnish with. We must take care to use it in the moist or wet state; as, if it becomes dry, it is impossible to preserve it in the minutely divided state, and we should run the risk of polishing the varnish in streaks. If, however, we would have the varnish still more shining, we must wash off all the remains of this fine chalk with water, and polish it with the palm of the hand, only slightly moistened. But, to have it still more brilliant, after having washed away all the chalk, and suffered it to become quite dry, we must pass all over it a thin coat of varnish, either in the sunshine, or in a warm stove, in order that the varnish may be extended uniformly upon the surface.

White Spirit of Wine Varnish.

Rectified spirit of wine . . .	24 ozs.
Fine sandarach	4 ditto
Fine turpentine	1 ditto
Spirit or oil of turpentine . . .	1 ditto
Camphor	2 *gros.*

We must select the most transparent sandarach, and that which is the least yellow; but if it be not of the best possible kind, we must wash it in a weak lie of potash, and then in a large quantity of water, and let it dry perfectly. For the quantity above directed, we must take a bottle of white glass, well dried, and of the capacity of forty ounces; and, after pulverizing the sandarach, we reduce the particles of it to a kind of thin paste, by triturating it with some of the spirit of wine, and put it by degrees into the bottle. We likewise mix the turpentine and the oil of turpentine together, by rubbing them up in the same mortar; and when the turpentine becomes more liquid, we may increase its liquidity by adding some spirit of wine to it, and pour it into the bottle, when we must shake it for some time, in order to mix the materials well together. We likewise put the camphor into the mortar, and beat it up with some drops of spirit of wine; we then add a larger quantity of the spirit, which will entirely dissolve it; this is then to be poured into the bottle, and it must be again well shaken for some time, in order thoroughly to mix all the materials together. The bottle must then either be exposed to the heat of the sun, or that of a warm stove, for ten or twelve days, taking care to shake it from time to time, and to unstop it, in order to suffer the vapour to escape; but, finally, it must be close stopped, and the varnish kept for use.

On applying the Varnish to Wood.

We place the subjects, which we would varnish, either in the sun-shine, or in a warm stove. We then apply six, eight, or ten coats of varnish. We must take care never to apply a second coat until the former one has become quite dry. If we would give the piece of work a fine lustre, we may polish the varnish, after the last coat is become quite dry, with finely washed chalk, applied whilst wet upon a soft woollen cloth. Or we moisten the palm of the hand, and rub the varnish with it, until it has acquired a perfect polish. Before applying the varnish upon wood, however, we must always prepare it by a coat of glue.

On fixing Prints upon Wood, in their natural position, and removing the Paper from them.

We select a surface of any kind of wood, the size of the print; we then moisten a piece of thick drawing paper, of a proper size, and apply upon its surface a layer of thin glue; we then suffer it to dry, and give it two or three more coats of the same glue, letting it dry between each coat; we then prepare the surface of this paper, to receive the print, in the same manner as the wood was prepared, as described in the first part of this article, by coating it with several layers of spirit varnish. We then apply the print, and conduct the operation exactly as before, to the period when we remove the last portions of oil by means of starch, and give several layers of varnish. The wood being then prepared to receive the print, by the coat of glue, and several layers of varnish, applied in the manner before described, we fix upon it the leaf of drawing-paper, bearing the print upon its prepared surface. We then apply a coat of varnish to the wood, and affix the prepared paper and print upon it, whilst it is still tacky; and so as to prevent the forming of any blisters or air-bubbles between them. When we think that the varnish is become hard, with the help of warm water and a sponge, we moisten the glued paper which covers the whole; we then remove that paper, which readily comes off; and, with the aid of the warm water and the sponge, we cause the glue to disappear from the varnished surface of the print; we then polish it with prepared chalk, and finish it, as before stated. This process may also be employed, not only to apply prints upon the surface of wood, but also upon metals, &c.

XLVII.—*On the great Increase of the British Iron Trade*[*].

The commerce in iron, that precious help to labour, is a sort of scale by which we may estimate the progressive or retrograde states of the manufactures and agriculture of Great Britain, both in regard to its foreign commerce, and the national consumption of it. The progressive improvements in manufactures and commerce are in the direct ratio of their prices; the public interest, nevertheless, requiring that its high price should be limited, when it has too rapidly increased, on the one hand, renders it difficult and even impossible to execute the numerous national internal demands, and those of foreigners, on the other hand; and, indeed, the raising its price too high, obstructs the means of sustaining a competition with foreigners.

---

[*] From the *Journ. des Connaissances Usuelles.*

There is little fear that this limit should be exceeded, when we see, that for several years, the high prices have been proportionate to the demands for cast and wrought iron, for making water-pipes and gas-pipes, for iron railways and carriages, for steam-boats, iron bridges, viz. either solid or suspension bridges, iron cables, steam-engines, and the other innumerable machines of this kind. We may form some idea of these demands when we learn, that a single iron rail-way, and its appendages, to be constructed between Liverpool and Manchester, will cost nearly two millions of francs! And lately, orders have been given for four hundred wrought-iron wheels for the waggons, and two hundred axle-trees. The rail-ways which have been planned, and the execution of which has already commenced in several places, will require the employment of iron to the amount of twenty-eight thousand pounds sterling. The one hundred and eleven miles of communication between Liverpool and Manchester, will finally demand 6000 tons of this metal, value £80,000.

The demand and the price will always preserve their just proportions; and although they in some degree suffered in the commercial crisis of 1825, yet this national manufacture, and the demand for foreign supplies, have greatly increased. It will no doubt be agreeable to our readers to present them with a table of the progress of this trade, and which owes its existence to the employment of pit-coal, the prime element of the manufactures and wealth of England.

England and Scotland did not possess, in 1740*, more than fifty-nine high furnaces; their number has since increased in the following proportions:

---

* It was in this year that the pit-coal was first tried for the purpose of extracting cast-iron from its ores; it began to be generally used in 1750.

In 1740,	59 furnaces produced	17,000 tons.
1788,	85	68,000
1796,	112	125,000
1806		250,000
1820		400,000
1827,	284	690,000

It is in the following counties, and in these proportions, that this prodigious quantity is manufactured.

Staffordshire	75 furnaces, producing	216,000 tons.
Shropshire.	31	78,000
South Wales	90	272,000
North Wales	12	24,000
Yorkshire.	24	43,000
Derbyshire	14	20,500
Scotland.	18	36,500
	284 furnaces, yielding	690,000 tons.

The rapid increase of iron rail-ways, so favourable to the working of coal and iron mines, has proportionally increased the number of iron-works in Scotland. The city of Glasgow, in 1789, had but one single foundry, whose products did not exceed twelve tons per week. In 1817, this city and its precincts possessed twenty-three, yielding twelve hundred tons of iron castings at the least!

We believe that about seven-tenths of this total fabrication, is destined to form iron-castings, and nearly the whole is consumed in the three realms; France and America taking but a small proportion: the three other tenths are converted into bar and sheet iron, steel, &c., and form one of the principal branches of exportation to America and the Mediterranean. The mean annual amount of the exportation of iron and steel, in bars and wrought works, is from £1,200,000 to £1,500,000. The single article of bar iron, was entered, in 1826, at £87,724. It is to be remarked, that the importation of bar iron, is principally from Sweden, and amounted to £226,526; and we see, from the increase of the duties, that its price was raised, in 1824, nearly from £27 to £28 per ton; whilst that of the English bar iron did not exceed £13. The exportation of iron and steel, from 1824 to 1827, increased from £851,578 to £1,107,724; whilst the exportation of wrought-iron and steel goods fell from 214,000 quintals to 192,000. The increase in the export of the unwrought metal of £250,000, in three years, announces a proportional increase in the manufacturing industry of other people.

To give some idea of the importance of these establishments, we shall cite that of Cyfartha, at Myrthir-Tidryl, in Glamorganshire. It belongs to Messrs. Crawshay & Co. Its annual product is 11,000 tons weight of pig-iron, and 12,000 tons of iron in bars. A steam-engine, of the power of fifty horses, and a water-wheel, of fifty feet in diameter, work the cylindrical blowing-machines, which are indispensably necessary in the use of coke, and the other machinery of the works. This enormous water-wheel is kept in motion by the pressure of twenty-five tons of water per minute. The establishment employs from 1500 to 2000 workmen, forming, with their families, a population of 4000 persons. The sum total of their wages amounts annually, to, from £70,000 to £80,000!

The price of iron, which, during the war, was always sufficiently high, has fallen prodigiously since the peace. It was raised, in 1823, from £7 to £13 per ton, for the best qualities of bar iron; the iron in pigs, rose from £4 10*s*. to £8 10*s*. and even £11 per ton; the bar iron varied from £9 10*s*. to £13, and even to £18 10*s*. per ton. The mean actual price is £9 10*s*.

XLVIII.—*On an Apparatus for evaporating Syrups*[*].

This apparatus, which has been recently established in France, and for which the inventor has obtained a brevet, is chiefly remarkable for its great simplicity. A copper boiler, hermetically closed, and some wooden vessels, in fact, compose the chief part of the apparatus. The vacuum is made by steam, and the steam is afterwards condensed by cold water, so simple is the process. The apparatus does not require the employment of any pump, nor of any other auxiliary machine, as it performs its functions without motion. And thus, not only is the vacuum produced and preserved without the aid of the phneumatic pumps, which are employed in Howard's English apparatus, but the water necessary for the condensation, rises of its own accord into the reservoir destined to receive it, and which is elevated from eight to ten feet above the surface of the earth. The management of the apparatus is also much less complicated than that of Howard; and thus a workman possessed of the least degree of intelligence can govern it; in fact, it is reduced merely to the turning of a few cocks! The steam is also produced under the ordinary pressure, which removes all idea of danger. The proofs are taken by drawing out the boiled sugar into threads, as usual; and an instrument is applied to the boiler, which permits us to extract a small portion of the sugar from time to time, and without suffering the air to enter the boiler. This instrument differs entirely from that used in Howard's process, it is not only more simple, but is also more convenient.

---

[*] From Ferussac's *Bulletin des Sciences Technologiques*.

M. Leclerc, a manufacturer of sugar from the beet-root, is the first person in France, who has adopted this new apparatus at his sugar-refinery, near Péronne. He employs the steam produced from a covered boiler, in which the juice is concentrated before it is clarified. This boiler thus serves as a steam generator. The steam thus produced heats the boiler (the vacuum-pan of Howard's apparatus) in which the syrup is brought into a state of ebullition. The withdrawing of the atmospheric pressure from its interior, permits us to obtain this ebullition without heating the steam to more than eighty degrees of Reaumur's thermometer. The sugar boiling is thus effected at a temperature of from fifty to sixty degrees. It depends upon the workman to regulate this internal heat, and which he can raise or lower at will. Experience has, however, proved, that it is necessary to elevate it to sixty-eight degrees towards the end of the boiling, in order to give the syrup the temperature necessary to produce a good crystallization of the sugar. This effect, however, is still obtained, withour suffering the air to enter, or injuring the vacuum. The internal pressure is indicated by a mercurial gauge, which varies in its range, according to the density which the steam has acquired. The exclusion of the air is perfect, and the vacuum is maintained without being perceptibly weakened during the whole course of operation, prolonged, as we see, many hours. Whereas, in order to produce a vacuum in Howard's apparatus, pumps are required, which must possess a degree of perfection difficult to give them. M. Roth's apparatus is capable of being established upon any scale which may be required, and in all localities. The want of water need be no obstacle. Firstly, the quantity required, is much less than that which is employed in the English sugar-refineries, it is about a fourth part only; three litres and a half of water being required for each litre of syrup. And, secondly, it is possible, and even advantageous, not to replace that which has served for the condensation. On leaving the apparatus, it has acquired a temperature of from forty to forty-five degrees; and it is received into a reservoir, placed outside of the buildings. After arriving at this reservoir, its surface is not long in cooling. The tube, of aspiration, intended to elevate it again to the apparatus, takes it from the bottom of the reservoir; this alternate motion of rising and falling, may be continued, with the same mass of wter, for a longer or a shorter time; nay, it may be prolonged indefinitely, provided the water is not suffered to become putrid. This inconvenience may be avoided by saturating it with lime.

The vacuum-pan, in M. Roth's apparatus, evaporates from an equal surface, with much greater speed than an open boiler, placed over an open fire. When established upon a proper manufacturing scale, one pan will boil nearly 4000 litres of syrup daily.

We can believe, after what has been above stated, that the expence of establishing this apparatus cannot be great. According to report, it is beyond all comparison, in this respect, with that of Howard. Its construction is solid and simple, and the absence of all friction renders the keeping of it in repair easy, and, of course, at but little expense.

The advantages which it presents, are, first, to produce an economy in the heating; secondly, the boiling the syrups without weakening them, and thus affording better and more beautiful products; thirdly, making more sugar, and less melasses (about ten per cent.); fourthly, shortening the time of claying the sugar; fifthly, causing the inconvenient and noxious vapours usually produced from sugar-refineries to disappear; and, lastly, to procure a great quantity of hot water, applicable to various purposes.

Remarks by the EDITOR.

Our readers will find two of the late Mr. Edward Howard's patents for sugar-refining, in our *Technical Repository*; and Mr. Barry has a patent for evaporating syrups, &c. in a vacuum, produced much in the above manner. We greatly doubt the success of M. Roth's apparatus; but if it should prove to be capable of producing the effects stated, and in so simple and facile a manner, it will produce a wonderful alteration in the present system of sugar-refining. We believe that the use of Mr. Howard's excellent, but expensive, apparatus, is not now extending here, although we know that it has been lately adopted at Vienna.

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since September 2, 1289.

To George Henry Manton, of Dover-street, Piccadilly, in the county of Middlesex, gun maker; for an improvement in the construction of locks, for all kinds of fowling-pieces and fire-arms. Dated Sep. 2, 1829.—To be specified in two months.

To John Tucker, of Hammersmith, in the county of Middlesex, brewer; for certain improvements in the construction of cannon. Dated Sep. 9, 1829.—In six months.

To Thomas Shaw Brandreth, of Liverpool, barrister at law; for a new method or methods of applying animal power to machinery. Dated Sep. 9, 1829.—In six months.

To Joseph Ange Fronzi, of Upper Marylebone-street, in the county of Middlesex, esq.; for certain improvements on, or additions to, fire-places. Dated Sep. 9, 1829.—In six months.

To James Soames, Jun., of Wheeler-street, Spital-fields, in the county of Middlesex, soap maker; for a new preparation or manufacture of a certain material produced from a vegetable substance, and the application thereof to the purposes of applying light, and other uses. Dated Sep. 9, 1829.—In six months.

To Thomas Morgan, of the parish of Tipton, in the county of Stafford, manufacturer of tin-plate; for a new method of manufacturing or preparing iron-plates, or black-plates, for tinning. Dated Sep. 9, 1829.—In six months.

To Robert Torrens, of Croydon, in the county of Surrey, a lieutenant colonel in the royal marines; for certain apparatus for the purpose of communicating power and motion. Dated Sep. 9, 1829.—In six months.

To David Lawrence, of Strood, and John Crundwell, of Ashford, both in the county of Kent, gun makers; for certain improvements in apparatus to be applied to fowling-pieces, and other fire-arms, in placc of locks. Dated Sep. 15, 1829.—In six months.

To George Harris, of Brompton-crescent, in the county of Middlesex, captain in the royal navy; for improvements in the manufacture of ropes and cordage, canvas, and other fabrics or articles, from substances hitherto unused for that purpose. Dated Sep. 15, 1829.—In six months.

To James Milne, of Edinburgh, architect; for a machine or engine for dressing of stones used in masonry, by the assistance of a steam-engine, wind, a horse, or water power, whereby a great quantity of manual labour will be saved. Dated Sep. 15, 1829.—In six months.

To John Aitchison, of Clyde-buildings, in the city of Glasgow, and county of Lanark, merchant; for certain improvements in the concentrating and evaporating of cane-juice, solutions of sugar, and other fluids. Dated Sep. 15, 1829.—In six months.

To Thomas Cobb, of Calthorpe-house, near Bradbury, in the county of Oxford, esq.; for certain improvements in the manufacture of paper intended to be applied to the covering of walls, or the hanging of rooms, and in the apparatus for effecting the same. Dated Sep. 15, 1829.—In six months.

To Robert Westwood, of Princes-street, Leicester-square, in the county of Middlesex, watch maker; for certain improvements in watches and time-keepers. Dated Sep. 23, 1829.—In six months.

To Isaac Brown, of Gloucester-street, Clerkenwell, in the county of Middlesex, watch maker; for certain improvements applicable to watches, and other horological machines. Dated Sep. 23, 1829.—In two months.

To Hayward Tyler, of Warwick-lane, in the city of London, brass-founder (being one of the people called quakers); for certain improvements in the construction of water-closets. Dated Sep. 23, 1829.—In two months.

GILL'S
TECHNOLOGICAL & MICROSCOPIC REPOSITORY.

XLIX.—*On the Microscope. By* THOMAS CARPENTER, *Esq. With Remarks and Additions. By the* EDITOR.

WITH A PLATE.

DEAR SIR, *London, October 12th,* 1829.

IN your fourth volume, page 73, you have described a minute scale taken by me from the wing of the butterfly *Lycæna Argiolus;* and a drawing of which you have given in plate II. fig. 30. As this object presented a very singular appearance under the microscope, I was induced to examine some other specimens of the same genus, in the expectation of discovering other scales equally curious, nor have I been disappointed; having met with some which are very minute, but whose characters, for beauty and regularity, in my opinion, exceed the former. These I found on the wing of the *Lycæna Adonis* (the Clifton blue), lying under the upper surface of other scales, with which the wing of this insect is profusely adorned.

I had met with a similar kind of scales, some time back, on the Dartford blue butterfly; and, on showing them to the late Dr. Wollaston, he informed me that he had seen such before, and termed them his favourite battledores, from their shape resembling that instrument. As the families of butterflies and moths open an extended field for interesting microscopic objects, in the numerous scales or feathers with which these insects are covered, and at the same time are so diversified in shape and characters, when taken from various parts of the same individual species; so I would recommend to your microscopic readers, to collect from this never failing source, by which means, they will furnish themselves with infinite numbers of highly interesting objects. I have been lately induced to extend my researches into this ample field, in consequence of my friend, Mr. William Tulley, the celebrated optician, of Islington, having lent me a double achromatic object glass, of four-tenths of an inch focus, until he can make one for me, of much more penetrating powers. The achromatic object glass he has been so obliging to lend me, defines this kind of objects in a most perfect and distinct manner, and it is highly creditable to his talents, as the constructor of it. I have selected scales from various parts of the under mentioned lepidopterous insects, and which I will submit to your inspection, when I have the pleasure of a visit from you. viz. the Menelaus, brassica, Apollo, Nestor, Achilles, currant sphynx, twenty plumed moth, dot moth, poplar hawk moth, humming bird moth, buff tip moth, small magpie moth, yellow underwing, lady of the wood, Dartford blue, orange tail, and letter *y* moths; also the silvery arches moth, Emperor moth, noctua brassica, peacock butterfly, privet moth, white plumed moth, puss moth, March dagger moth, Adela, and Atlas moths. And also from various moths, whose larvæ are so destructive to clothes, and other articles. Many of the scales from the above, will be found excellent test objects; the lines in them being made out with great difficulty, and not without the proper management of reflected light. Indeed, I consider, that the effect to be produced, depends almost as much on the proper distribution of light, as upon the excellence of the object glass. Although the above scales are mounted as transparent objects, yet they may also be viewed as opaque ones, by placing a narrow piece of black card behind the slider; and as many of them possess a fine metallic lustre, so they will be found very splendid objects, when viewed under the opaque speculum. Amongst those scales selected from the Atlas, puss, Adela, currant sphynx, and silvery arches moths, several will be found highly interesting, both in shape and as test objects. I now also send for your inspection a few varieties of scales, taken from the wing of the common gnat, you will have much to admire in these very minute objects; you have already given a portion of the wing of this insect highly magnified, showing the scales with which it is fringed, but these scales differ very much from those. Also some scales from a species of podura, which I found on a piece of leather, in the upper room of an uninhabited house. The characters in these scales, are very difficult test objects, but in shape they very much resemble those from the podura found in cellars, as mentioned by you, in a former number. Last summer I met with some exceedingly minute insects, within the flower of a poppy; a species of Thrips *(T: minutissima)*. These insects are scarcely visible to the naked eye, yet, minute as they are, they are furnished with wings of such exquisite workmanship, and such extreme delicacy of texture, as to excite astonishment, at so much perfection being displayed in an almost invisible speck! In the antennæ there is also much beauty to admire.

A singular circumstance occurred to me, respecting the breeding of a species of house-fly, and which I beg to relate. In the month of October, 1818, some of these flies had found their way into a long necked bottle, which had contained some saccharine mixture; and the sweetness of which, I suppose, had attracted them. After feeding some days, the females deposited numerous eggs within the bottle, and died. Shortly afterwards, the larvæ were excluded from the eggs, and not meeting with other food, they devoured the bodies of their dead parents. As the dead flies within the bottle were numerous, the larvæ had a sufficient supply of food, until they went into the crysalis state, in which they remained until the latter end of November, and then came forth perfect flies. I herewith send you some specimens of the larvæ, pupa, and perfect insects; one of the flies you will perceive, was about to come forth from the crysalis case, at the time it died. I also send three of the larvæ, placed between two slips of glass; the granulations and other characters on the skins of these, are well worth your close inspection under the microscope.

With the above transparent objects, I also send you a few opaque ones, and which you will find equally interesting on examination.

In vol. II, page 140, of your work, you have described the curious apparatus or saws, situated at the end of the abdomen of a species of *tenthredo*, or saw-fly. I herewith send you one of the perfect insects, in which you will observe one of the saws, as it lies when in a state of rest; you will have much to admire in the beautiful irridescent colours of the wings of this insect, and also its head, eyes, and formidable jaws, which I have set open, to show their capability of committing destruction among the larvæ of other insects, on which this fly is destined to feed. I also send you the head of the *dyticus circumflexus*, whose larva you have described, in a former part of your *Technological Repository*. This you will find a very interesting object under the speculum. I have placed it on a piece of card, with a view of its under side, in order that you may see its powerful mandibles, together with the various apparatus attached to them. This is the insect, whose fore feet are so beautifully and curiously constructed, with numerous cups appended to them; and which have been also described by you, in vol. II, page 141.

I likewise send you two species of the genus *staphilenus*, differing much in size and colour from each other. The larger one having a ferocious and ugly appearance; but the smaller one possessing great beauty, in the various colours with which it is adorned. This genus comprises a very extensive family, there being nearly two hundred known species. The larger ones bite very severely, and which I very sensibly felt, at the time I took up from the ground the one I send you. The feet of this insect are furnished with tufts of hairs, resembling brushes under the microscope. On attempting to lay hold of one of these insects, it uniformly turns up its tail, as if it intended to sting; they are, however, unprovided with stings, and are only capable of inflicting a wound with their jaws. These I have placed open, in order that you may observe their great strength, and formidable appearance.

Lastly, I send you a few darts, taken from the neck of the garden snail. These I received from the late scientific Mr. Sowerby, who informed me, that he had dissected the snail, in order to ascertain whether the statements put forth by various naturalists, respecting these creatures possessing such curious instruments, were founded in fact; and the result of his investigation proved they were so.

It appears that the mode of breeding, in the garden and a few other species of snails, is extremely curious; and too well authenticated to be doubted. At a certain time of the year, they meet in pairs, and, stationing themselves an inch or two apart, launch several little darts, not quite half an inch long, at each other. These are of a shelly substance, and sharply pointed at one end. The animals, during the breeding season, are provided with a little reservoir for them, situated within the neck, and opening on the right side. On the discharge of the first dart, the wounded snail immediately retaliates upon its aggressor, by ejecting a similar one; the other again renews the battle; and, in turn, is again wounded. Thus are the darts of Cupid, metaphorical with regard to all the rest of the creation, completely realized in snails.

After the combat, they meet together; and each of them lay its eggs in some sheltered and moist situation, generally under a small clod of earth, or in some cool cavity.

The eggs are about the size of small peas, semi-transparent, and of a soft substance, some of which I now send you in spirits.

From these eggs the young snails are hatched, completely formed, with shells on their backs; and they undergo no further change, than what necessarily takes place in the gradual increase of their bulk. The darts I now send are of various sizes; and some of them appear not to have quite arrived at maturity. What a wonderful provision is here made to arm these despised creatures!

I remain, dear sir,
Your sincere friend,
THOMAS CARPENTER.

To THOMAS GILL, *Esq.*

References to the figures, and Remarks. By the EDITOR.

IN plate V. fig. 1 is one of the highly magnified battledore-shaped scales, from the wings of the moth *lycæna Adonis.*

Fig. 2 is a highly magnified view of a scale or feather, taken from the wing of the Atlas moth; in which, besides the linear divisions, a curious effect, resembling the watering in woven fabrics, will be seen.

Figs. 3 and 4 are two of the feathers or scales taken from the wings of the puss moth, highly magnified.

Figs. 5 and 6 are two of the slender and pointed feathers or scales from the fringe of a gnat's wing, shown as highly magnified; and fig. 7 is another kind of scale, also taken from the same insect.

Fig. 8 is one of the delicate wings, and an elytra of a thrips, shown as greatly magnified.

Fig. 9 is part of the curiously granulated skin of the larva of a species of house-fly, highly magnified.

Fig. 10 is an upper magnified view of the head of a *tenthredo,* or saw-fly; showing its powerful jaws, palpi, or feelers; antennæ; two compound eyes, and three stemmata, or single eyes, behind its head.

Fig. 11 is a magnified under view of the head of the *dyticus circumflexus,* or water-beetle; showing its two sets of jaws, and palpi, or feelers; its two compound eyes, and its antennæ; not greatly enlarged.

Fig. 12 is one of the darts, extracted from a garden snail; moderately magnified.

On the Circulation of the Sap in the Chara translucens.

Mr. Mylne, of Clapton, is, we believe, the first microscopic observer who has discovered the circulation of the sap in a plant, in this country. Professor Amici, of Modena, had indeed discovered it in the *Chara vulgaris* a few years since, as announced in several scientific publications. Mr. Mylne has, however, lately discovered it also in another species of the same genus, the *Chara translucens*, a very common aquatic plant, growing in ponds, where the water is clear. Its leaves are whorled, growing in circles round the stem; and it bears both male and female flowers; the male flowers being of an orange red colour, and in the form of small spots, adhering to the leaves, as shown magnified in fig. 13 of plate V. When expanded, they appear under the microscope, and highly magnified, like fig. 14; they consist of a stem, with numerous transparent filaments adhering to it, which are flattened, and covered with red spots. The female flowers are green, and of a conical shape, being surrounded with spiral ribs. The stems are likewise surrounded with spiral ribs, as shown in a part of one, in fig. 15. This is in the state fit for exhibiting the circulation of the sap under the microscope; the upper and lower parts of it being cut off, but the joints at each end preserved. It ought to be quite fresh, or just taken out of the water, and be placed in a watch glass filled with water, upon the stage of the microscope, when the sap will be seen circulating up one rib and down the next adjoining ones. We have not seen this interesting sight ourselves, but have no doubt of the fact being as stated; Mr. William Tulley, of Islington, having seen it, as exhibited to him by Mr. Mylne, and explained the circumstances to us. The Editor was favoured with a recent specimen of the plant in flower, in August, 1828, by Mr. Gray, of the British Museum; whose object, however, was not to exhibit the circulation of the sap to him, but only the curious structure of the parts of fructification in it; and, although the Editor frequently placed parts of the plant under his microscope, yet he did not perceive any circulation of the sap in it. He will, however, endeavour to do so next year.

On another Species of Pectinated Mite. Mr. T. Carpenter having recently placed in the hands of the Editor, the dust from various seeds, as procured from his seedsman, with a request that he would examine them under his microscope, he has accordingly done so, and has found fine living specimens of the pectinated mite, described by the late Dr. George Shaw, in the dust of rape and radish seeds; and in that of the turnip, pectinated mites, having a pecten or comb attached to four of their legs, as shown in fig. 16, instead of two only, as in Dr. Shaw's mite. The two foremost legs on each side, are those which are furnished with the combs; the other four legs, or the two hindermost on each side, not being provided with any.

L.—*On the Precautions which ought to be taken in the Preparation and Use of the various Inventions for producing Instantaneous Light*[*].

"The first apparatus of this kind, were the *phosphorus bottles*; and, for a long time, they were only prepared by the makers of philosophical instruments. They were made by introducing a certain quantity of phosphorus into small bottles, which were then placed upon a sand-bath, and when the phosphorus was melted, they repeatedly plunged into them a red-hot iron; by this means, a portion of the phosphorus became oxided, and the mixture which resulted from the operation, enjoyed the property of inflaming, when brought into contact with the air. To light a sulphured match, it was sufficient to open or unstop the bottle, to plunge the match into it, and to rub off or detach a small portion of the phosphorus; and, upon withdrawing it from the bottle, the match was kindled. This contrivance, however, had the inconvenience of the phosphorus powerfully attracting the humidity contained in the air; so that in the space of a short time, and unless the bottle was instantly carefully closed, by a well-fitted ground stopper, it lost its effect."

---

[*] From De Moleon's *Recueil Industriel*, with additions by the Editor.

The Editor prepared these phosphoric bottles many years since, and found that a white saline efflorescence had formed itself, and covered the surface of the phosphorus; and, upon taking a little of it up, on the point of a match, and bringing it into contact with moisture, it instantly took fire, with a sudden flash of light.

"To these phosphorus bottles, the preparations known under the name of *Inflammable Mastic* succeeded, the first of which was invented by the Baron Cagniard Delatour. This preparation was free from the inconvenience of attracting the humidity of the air, and would last until the matter inclosed in the bottles was completely exhausted. This matter was phosphorus, in a particular state of combination, and which could not be imitated by any other manufacturers. But the price of it was too high, and others therefore endeavoured to make compositions possessed of similar properties, but at lower prices. In order to this, they mixed phosphorus with magnesia, and other earthy matters, but they did not possess the good qualities of the above mentioned ones; as they would only act for a short time, and became quickly spoiled."

The Editor recollects a composition of this kind being made by a chemical friend of his in London, and which was possessed of the above valuable property. The specimen he saw was inclosed in a bottle, and had a brown colour, and also smelled strongly of camphor; on a little of it being taken up on the point of a match, and brought in contact with the air, it quickly caught fire. The preparation of it was, however, kept secret.

"The *phosphoric bougies* were invented about this period. They consisted of slender glass tubes hermetically closed, of about the eighth of an inch in diameter, and four inches long; and they contained a cotton wick, dipped in white wax, and secured into one end of the tube; the other end of the cotton wick being placed in contact with a small portion of phosphorus, which, no doubt, had been oxided by the method indicated at the beginning of this article; and, upon breaking the tube across, at a place marked by a small band of paper, cemented around the tube, at the end opposite to that containing the phosphorus, and drawing out the cotton wick, the phosphorus upon it instantly caught fire. These continued in use for a considerable period, but they had also the misfortune of being too dear.

"To these succeeded leaden bottles, each containing a piece of solid phosphorus, and closed with corks. Upon taking up a little of this phosphorus on the point of a sulphured match, and rubbing it backwards and forwards a few times upon a piece of cork or felt, the sulphur on the match combined with a little of the phosphorus, and kindled from the heat occasioned by the friction."

These leaden phosphorus bottles are now commonly sold about the streets of London. They have the inconvenience, however, of the mass of phosphorus being exceedingly liable to take fire, and thus to do mischief; and they also then become useless, until the phosphorus is replaced.

The Editor well recollects his friend Mr. J. T. Cooper, Lecturer on Chemistry applied to the Arts, several years since preparing matches tipped with sulphur and phosphorus; and which quickly ignited, when rubbed upon a piece of cork. Possibly the common sulphured matches may be rendered capable of quickly igniting in this manner, by merely rubbing their points upon a stick of phosphorus, placed in a shallow vessel of water, to prevent it from taking fire from the friction. The matches ought to be prepared, however, shortly previous to using them, and before the phosphorus is become decomposed; and they should likewise be kept in boxes, or close stopped bottles, and be thus secured from any danger of igniting by accidental friction.

The Volta's Lamp, in which the jet of hydrogen-gas is kindled by an electric spark, may be justly added to these instantaneous methods of procuring fire and light; and so also may be the fire-cane, and the still more portable instruments of a similar kind, as the fire-tubes, &c., for igniting German tinder, by means of strongly and rapidly compressed air.

"The modern chemists having discovered that the chlorate of potash causes combustible bodies to burn more rapidly than Nitre, thought of applying it to the preparation of gun-powder, and the first experiment which was made at Essone, cost the lives of the workmen; because they were ignorant that it would inflame, unless by the sparks produced by the contact of flint and steel, or by bringing it into contact with a burning body. Whereas, simple percussion, or the friction produced between two hard substances, was sufficient to inflame it with detonation! In consequence, the preparation of these mixtures was exclusively confined to the laboratories of the chemists, and designated in their writings, by the name of fulminating powders.

"But as it was also known, that this combination had, amongst other qualities, the property of inflaming, by simple contact with the concentrated sulphuric acid; so they were not long in bringing this property into use, and which offered great advantages in kindling, what are now termed, the *oxygenated matches.*

"It is convenient to divide the manufacture of these oxygenated matches into two parts. The first, consists in inpalpably pulverizing the chlorate of potash, and intimately mixing the powder with flour of sulphur. But, as we have before mentioned, a similar mixture violently detonates by percussion, or merely by the simple friction between two hard bodies, such as the pestle and mortar, or the muller and grinding-stone. The accident at Essone was not the only one of the kind. M. Rochette, jun. an optician, residing at Paris, and who was one of the first persons who manufactured the oxygenated matches for sale, lost his life from a detonation, occasioned by preparing this mixture for use; and a loss was besides sustained, amounting to more than 1200 francs.

"Another druggist of Paris, also lost a young man, owing to a similar accident; and we could mention many others. And indeed in two particular instances, the quantities of the mixture operated upon, amounted only to a few ounces in weight. But now adays, and in consequence of the great consumption made of these oxygenated matches, we cannot too much recommend the proper authorities to superintend the manufacturers, who prepare many pounds of this mixture daily, and to oblige them to remove their workshops to a distance from any habitation; and also to make a law, to prevent them from mixing the composition with gum-arabic. It is in vain they say, that the detonating mixture is modified, and that they have diminished the proportion of chlorate of potash, by substituting nitre in place of it. As it is a fact, that this new mixture is not less detonating than the former one!

"The second part of the manufacture of these oxygenated matches, consists in making a thick fulminating mixture of the chlorate of potash, sulphur, and nitre, by tempering them with a sufficient quantity of a weak solution of gum-arabic in water. Sometimes the manufacturers add a little vermillion to the mixture, to colour it red; but they frequently leave it of its natural colour, which is a pale yellow. It is sufficient to plunge the extremity of the match into one of these thick mixtures, to the depth of about the eighth of an inch, and to leave it to become dry. The matches are similar to the common ones, except that they are only sulphured at one end, and are made of double the thickness.

"This second part of the manufacture presents no danger, and may therefore be permitted, without inconvenience, to be carried on in Paris. It is even advantageous, as it employs young children, and removes them out of the way of contracting those vicious habits, which idleness generally brings upon the poorer classes of people.

"To make use of these oxygenated matches, it is sufficient to plunge the prepared end of one of them into a small bottle containing asbestos, imbibed with concentrated sulphuric acid, and instantly to withdraw it. The sulphuric acid acts upon the deflagrating matter, and inflames it, as well as the sulphur, and thus kindles the match. These matches have no other inconvenience than that of burning small holes in the clothes of those persons who are in the habit of using them.

"The detonating or fulminating matches, are those, which after being lighted by any means, at a certain period of their burning, make an explosion. These matches are more costly than the others; and, consequently, are only purchased by persons who know what they require. At present, they are only sold by the dealers in objects of philosophical amusement. The preparation of these matches is simple: it consists in making, by means of a small gouge, an excavation in the stem of the match, at about a third part of its length, from the prepared end of it; and raising up the loosenend part of the wood, introducing into the hole, made at the farther end, an atom, either of fulminating silver, or fulminating mercury, but especially the former; and then glueing up fast the small slice of wood raised by the gouge,

"These detonating matches present no danger, but only to the persons preparing them, and even that danger is not great; as with a *gros* weight only of the fulminating material, they may prepare many hundred matches; and the consumption of these being limited, the manufacturers consequently never keep any considerable quantity of the fulminating matters by them. We therefore think, that the manufacture of these detonating matches may, without inconvenience, be permitted in the city. It is always easy to distinguish these detonating matches from others. It is sufficient to examine them; and we may always perceive a part upon their stems which shines, and indicates the place into which the fulminating material has been introduced, and finally glued over. Nevertheless, we should wish that persons would cease to make use of this kind of sport, which, in many circumstances, is not without danger; owing to the fright which they occasion, and to females in particular, when they are thus taken by surprise."

We find an instantaneous light, lately described in *The Quarterly Journal*; and which is evidently formed by the application of detonating silver, or fulminating mercury, to the surface of the wood at the end of a match. It is thus described: " Instantaneous Light.—Amongst the different methods invented in latter times, for obtaining a light instantly, ought certainly to be recorded that of a chemist, at Stockton upon Tees. He supplies the purchaser with prepared matches which are put up in tin boxes, but are not liable to change in the atmosphere; and also with a piece of fine glass-paper, folded in two. Even a strong blow will not inflame these matches, because of the softness of the wood underneath; nor does rubbing upon wood or any common substance,produce any effect, except that of spoiling the match. But when one is pinched between the folds of the glass-paper, and suddenly drawn out, it is instantly inflamed." Now we well know that detonating silver will readily explode by the friction of glass-paper, and is accordingly employed in many various ways, as in the laces, tapes, or girths of security, against housebreakers, &c. &c.; and therefore these new instantaneous lights are no doubt formed, by its application to the points of these soft wood matches, and most probably in mixture with camphor, resin, sulphur, or other inflammable materials. Care ought, however, to be taken in their use, lest, by falling upon a sanded-floor, and being accidentally trod upon, they may take fire, and thus do great mischief!

We well recollect serious accidents having been occasioned, by the chemists who first prepared the fulminating silver here, not being fully aware of its nature; and, in particular, Mr. J. T. Cooper, losing his eye-sight for a considerable time, owing to a portion of it exploding, even whilst still wet, in a Wedgewood's evaporating bason, merely by touching it with a steel spatula! It besides fractured many glass vessels, and several panes of the windows; and even drove pieces of the bason into the wooden table, upon which he was at work: too much care cannot therefore be taken in employing this dangerous substance.

We have lately had another instantaneous light apparatus introduced under the name of the Promotheans. These are small glass bulbs, filled with concentrated sulphuric acid, and hermetically sealed, and surrounded with a mixture of inflammable materials, amongst which the chlorate of potash, forms one; and the whole being again inclosed or surrounded with paper, also rendered still more inflammable by means of resinous matters. Upon pinching the end containing the glass bulb, between the jaws of a pair of pliers, the bulb breaks, and the sulphuric acid instantly kindles the surrounding materials. These Promotheans are, however, expensive; and care ought to be taken that the remains of the sulphuric acid, &c., do not come into contact with delicate furniture, clothes, books, papers, &c., lest it may lead to their destruction. The chief merit of this contrivance lies in securing the sulphuric acid from all danger of imbibing the moisture of the air, which is the great cause of the speedy failure of the acid bottles employed in kindling the oxygenated matches. These Promotheans are patented by the manufacturer of them.

We have now also to add to these numerous means of procuring instantaneous light, Dobereiner's discovery of the igniting action of a jet of hydrogen-gas, when thrown upon a mass of the spongy platina, and which is now employed in a variety of ways, perhaps in none more successfully, than in the apparatus invented by Mr. Jackson, surgeon, and which obtained the approbation and reward of the Society of Arts, &c. &c.; and a description of which we gave in our fifth volume, page 21.

The kindling of *amadou,* or German tinder, by the sparks produced from the collision of a flint and steel, now so very commonly used here in lighting segars, ought also to be included amongst the methods for producing instantaneous light. The Editor, many years since, improved upon this apparatus, by substituting a loosely twisted cotton cord, steeped in a solution of pure nitrate of potash, for the German tinder, and which readily kindled by the sparks produced from the flint and steel. He did not, however, content himself with merely igniting the cord, and which required the use of a sulphured match to obtain a light from it; but he also prepared the cord, by coating portions of it at regular intervals, alternately with sulphur, and then with wax; the sulphur readily kindled of course, by the ignited match-cord, and as readily lighted the wax; and thus a flame was produced, by one operation only. This flame endured sufficiently long to seal a letter, and perform other temporary offices; and might even be prolonged, by thus preparing the wicks of wax-bougies or candles of a greater length and thickness, with nitre and sulphur.

LI.—*On a Singular Effect, produced by Submarine Heat, or Electricity, upon a Chain-Cable.*

We are indebted for the following statement, to a friend lately arrived in town from Portsmouth. He was shown there a chain-cable, belonging to a vessel returned from South America; and which, in that part of it which was covered with the mud at the bottom of the ocean, during a violent earthquake, was completely fused, and the iron formed into large spherical masses, resembling, only upon a greater scale, the scoriæ of iron, when burnt in a smith's forge, by overheating it.

We must leave to philosophers, the task of accounting for this singular effect; contenting ourselves with merely recording the fact.

LII.—*On the Uses of Steatite; and particularly in the Lubrification of Machinery, to reduce Friction**.

STEATITE is a kind of saponaceous stone, which is sometimes found of a white colour, at others grey or green, and but rarely red or yellow. Its specific gravity varies from 2.60 to 2.66.

This substance is composed of a mixture of silex, alumine, magnesia, oxide of iron, and water; but it differs according to the localities in which it is found. It is very common in Germany, and in Cornwall; and we have no doubt that it may also be found in the western parts of France.

As steatite is not fusible but only at a very high temperature, and as it can be worked with the greatest facility, so it forms excellent crucibles, which harden in the fire, and which litharge penetrates with great difficulty. It also serves as a facing in the moulds for casting iron, and other metals.

M. Viscot, of Liege, made a great number of experiments to prove that this substance might be employed by the lapidaries. He formed cameos with it, to which he gave a fine polish, after exposing it to the action of the fire; and it becomes so hard, as to give sparks like flint, when struck upon hardened steel.

By polishing it, he gave the appearance of agate, and even obtained some pieces, which perfectly resembled the onyx; but this appearance quickly disappeared in the fire, and he found it impossible to restore it.

Having a great affinity with glass, the steatite, when reduced to a very fine powder, and mixed with the colours, becomes exceedingly convenient in painting upon it. It is also used as a kind of sympathetic crayon, for drawing or writing with upon glass, and on which it leaves no apparent trace, after the drawing or writing has been wiped over with a woollen cloth. However, the marks are rendered instantly visible, by breathing upon them; but they disappear anew, when the glass becomes dry.

---

* From De Moleon's *Recuiel Industriel.*

The embroiderers and tailors prefer steatite to chalk, to make traces with; as they are more durable, and do not affect the colours of their cloth.

As steatite has the property of combining with oil or grease, so it enters into the composition of the greater part of the balls, which are used for cleaning silks and woollen cloths from oil or grease spots. It also serves as a basis, in the preparation of certain colours for painting with.

It is employed to give a fine polish to marble, serpentine, and other gypseous stones. Mixed with oil, it is used to polish glass and metallic mirrors.

If the surface of newly prepared leather be sprinkled over with it; and if, when it has become dry, it be rubbed with a piece of horn, it will give the leather a fine gloss.

Steatite is also employed to glaze paper, upon the surface of which it is sprinkled, when it is reduced to a very fine powder; or, which is much better, when mixed with the colouring materials. To glaze the paper, it must be rubbed over with a hard brush.

The powder of steatite, owing to its unctuosity, is one of the substances employed in lessening the friction of screws, toothed-wheels, and other metallic contacts.

Steatite, is a mineral, which belongs to the primary or secondary formations. It often constitutes beds of great extent. But when it is pure, it forms lumps of greater or less magnitude. That variety of it, termed Venice talc, abounds in the Tyrol and the Valteline. The Briancon and the Spanish chalks are found, the one in the Alps of Dauphiny, near Briancon; and the other in the mountains of Arragon. The Venice talc affords a powder, which renders the skin smooth and shining, and is employed as a cosmetic. The lard stone is also another kind of graphic talc, and is used in China, to form small grotesque figures of.

Fat, and fixed oils, have long been used to lesson friction in machinery. But the bad properties, and the ill scents of these matters, ought to induce us to abandon their employment, and to substitute others for them. And we may likewise add, that the emanations which they diffuse in the workshops or mills, are greatly inconvenient; and it would therefore be much better to sell them to the manufacturers of oil-gas! Plumbago, or the carburet of iron, has been successfully used for diminishing friction in machinery; but this material is too rare and costly to be ordinarily used. There are, however, other unctuous minerals to which we may recur, and amongst these, steatite seems to hold the first rank.

The citizens of the United States of North America, who cultivate with success the employment of machinery, as we may judge from their numerous steam-boats and other machines, both for naval and other purposes, appear to be the first persons who have employed steatite in the large way. It is not, however, used alone, but mixed with a small quantity of oil, suet, or tar. They commence by reducing it to a very fine powder, and then mixing or triturating it with the material intended to render it more unctuous. The first experiments on using it were made at Lowell, in the state of Massachusets; and the coachmen and waggoners have found it highly beneficial.

Mr. Moody, superintendent of the great iron-works established upon the mill-dam, near Boston, has afforded us means of estimating the advantage to be derived from the use of this new mixture. In one of the works is a wheel of great size and weight, which makes from 75 to 100 revolutions per minute, and turns upon necks or gudgeons of five inches in diameter. It has moved with this speed during three, and sometimes five, weeks together, without renewing the lubrication of the gudgeons! Nevertheless, Mr. Moody thinks it best to renew it oftener. The machinery, of which this great wheel forms a part, manufactures about 200,000 pounds of iron per month.

It was to chance, that we are indebted for the discovery of this valuable employment of steatite, but which is now continually extending its use in the United States; and will also no doubt be speedily adopted in Europe.

Additions. By the EDITOR.

Steatite is also used in the United States to line furnaces with; a type-founding machine, sent from thence, and patented here, had a furnace of this kind. And the Editor lately saw, in the hands of Mr. Lemuel Wellman Wright, engineer, a cubic mass of it, a foot square, and which had been sent to him by an American friend. He had sawn off a portion of this block, and exposed it to the heat of his fire for several hours; after which, it had assumed the appearance of a mass of *mica,* still, however, cohering together. The Chinese also make small portable furnaces of steatite.

The *lapis ollaris*, or potstone, is also another variety of steatite. Bishop Burnet gives the following account, in his travels, of the mode of using it in Switzerland. "There are a sort of pots, made of stone, which are used, not only in all the kitchens here, but also in those of almost all Lombardy, called *Lavege.* The stone feels oily and scaly, so that a scale adheres to the finger of any one that touches it, and it is somewhat of the nature of slate. There are but three mines of it known in these parts; one near Chavennes; another, in the Valteline; and the third in the Grisons; but the first is much the best. They generally cut it round in the mine, in masses of about a foot and a half in diameter, and a foot and a quarter in thickness; and they work it into shape in a mill, where the blocks of stone are driven about by a wheel, set a going by water; and which is so ordered, that he who manages it, turns the outside of the stone, first, till it is quite smooth; and then separates one pot after another, by small and hooked chisels, by which means he makes a nest of pots, one within another; the outward and biggest one, being as large as an ordinary cooking-pot, and the inward one, no larger than a common pipkin. These pots they arm with hooks, and circles of brass; and so they are used by them in their kitchens. One of these pots heats and boils sooner than any metal pot; and yet the bottom is twice as thick as that of a metal this art. The success obtained has been such that it has one. It never cracks by the heat, nor gives any sort of taste to the liquor that is boiled in it; but if it falls to the ground, it breaks, as it is very brittle; nevertheless, it is soon repaired again; for they piece their broken pots so close, by sewing the broken parts together with iron wire, which completely fills the holes they make to receive it, that there is no breach made, although no cement is used. The passage to the mine is very inconvenient, for they must creep for near half a mile through a rock, which is so hard, that the passage is made not above three feet high; and so that those who draw out the stones, creep all along upon their belly, having a candle fastened to their forehead, and the stone laid upon a sort of cushion, made for it upon their hips. The stones are commonly two hundred weight."

LIII.—*On Refining Gold and Silver, and making Sulphate of Copper, at Paris. By* M. D'ARCET.

THE works, where the refining of the alloys of gold and silver is carried on, having, for several years past, greatly increased in Paris, and the art being practised on a large scale, and without using any precautions to prevent the noxious fumes, generated in the different processes, from diffusing themselves all around the works, it occasioned serious complaints to be made by the persons residing in their vicinity. The Council of Health were in consequence frequently employed, in consulting on the means to be taken to remedy these inconveniences; they studied the processes of this art, examined the different works where they were carried on, with a view both to perfecting them, and rendering more wholesome; and the Council at length found an opportunity to establish a complete refinery, upon a plan furnished by it, and in which should be combined the requisite means of avoiding all the causes of the insalubrity and the inconveniences hitherto attending the practice of now served as a motive for placing these improved works under the second class, according to the decree relative to unhealthy and inconvenient processes; a classification followed in those cases, where these processes were carried on in towns and in the neighbourhood of habitations. And the Prefect of the Police of Paris, has since thought it would be useful to publish a description of this improved refinery, and accordingly charged the Council of Health to undertake the task, and also to add to it instructions for facilitating the construction and employment of the new apparatus.

Instructions relative to the Art of Refining; drawn up by M. D'ARCET, *in the name of the Council of Health for the City of Paris, and Department of the Seine.*

The art of refining has for its object, the bringing into a state of purity, the gold and silver which is found alloyed with other metals, and to facilitate the oxidation of those metals which are of less value. This art has been practised from the most ancient periods. Gold was separated from the more oxidable metals by a long continued fusion; and also by cementation, in which process, sulphur and saltpetre were employed; but latterly, the sulphuret of antimony, and corrosive sublimate, were used to purify gold. For silver, the ancients extracted this metal from the alloys which it had formed with the more oxidable metallic substances, either by keeping those alloys in fusion for a long time, with the contact of air; or by treating them with sulphur or saltpetre. Cupellation and liquation were more recently employed in the refining of silver; and still more lately, they began to separate gold from silver, by means of the nitric acid, in the process termed *parting*. This last improvement is the most important of those which the art of refining has ever received; it has placed the refiners in a state capable of satisfying all the demands in the commerce of gold and silver; and the art has been carried on for many years since, without experiencing any sensible amelioration.

Since the Revolution, the exercise of this art having become free, it has been greatly improved by the substitution of the sulphuric acid in place of the nitric, for treating the alloys of gold and silver. The late abundance of the mineral platina in commerce, and the improvements in rendering it malleable, have likewise greatly contributed to carry the art of refining to a degree of perfection, to which it had never before arrived, and which it was difficult to conceive, could have been effected. We shall now enter into some details upon the subject, in order to prevent the knowledge of so great an improvement in the commerce of gold and silver from being lost, and for the honour of the men, who have contributed to procure these advantages to our manufactures; and also of the science, which has furnished the means of accomplishing it.

In 1789, the refining of an ingot of copper, containing silver, mixed with gold, was effected as follows:

They commenced by fusing it many times, with saltpetre, in order to separate the copper in it. They then granulated it, and treated it with nitric acid, by heating it in earthen vessels; the undissolved gold, was then treated a second time with the nitric acid, in a more concentrated state; it was then washed in a great quantity of water, dried, and melted with saltpetre. The different washings being united, were then saturated with copper, by being placed in contact with plates of that metal, and heated, until the silver was entirely separated, and this silver, thus precipitated in the metallic state, was washed with great care, dried, and fused with saltpetre and a little borax. All the liquors containing the nitrate of copper, were then evaporated to the consistence of a syrup, placed in large earthen vessels; and finally exposed to a heat capable of decomposing the nitrate of copper; an operation which occasioned the loss of nearly all the acid employed. They could then only bring the oxide of copper, which remained at the bottom of the earthen vessels, into the metallic state, by fusing it in a crucible, in contact with charcoal, either in the forge, or, still better, in a wind-furnace.

We see, that in this process, they employed a great quantity of saltpetre; and also used the nitric acid, which is very costly; that the vessels employed were very liable to break, and could but ill resist the variations of temperature; that nearly all the nitric acid employed in the solution of the alloy, was lost in the decomposition of the nitrate of copper by heat; that it produced abundance of acid vapours, and exceedingly deleterious gases; that a considerable loss was incurred, in the quantity of copper employed; and which could only be partly recovered, by fusing the numerous scorias and remains of the earthen vessels and crucibles; and then again treating the alloy obtained, in the proper manner to separate the gold and silver it held; and which, nevertheless, would hardly pay the expences of these operations to procure the fine gold and silver, which are the only vendible products; and which can now be more readily obtained, by following the improved process, which we shall proceed to describe.

In the new process of refining, which is now practised in Paris, nearly all the inconveniences which we have here enumerated, are avoided. The following details, when compared with the preceding ones, will be sufficient to demonstrate with what success our refiners have applied to their art all the resources of chemistry.

Supposing then, as we have above said, that the question is, to submit to the refining process an ingot of copper, containing also gold and silver; the refiner, in following the new process, first melts the ingot, and granulates it, without employing any nitre; these grains are then treated by the sulphuric acid, contained in platina vessels. The gold separated from the silver, is then treated a second time, with a new portion of the acid; and is then washed, dried, and fused with a little saltpetre. The sulphate of silver is then decomposed, by heating it, in contact with plates of copper; the precipitated silver, after being washed and dried, is then fused with a little nitre and borax, and poured into an ingot-mould. The solution of sulphate of copper obtained, is purified, by heating it, and adding a sufficient quantity of the oxide of copper to it; it is then evaporated to a proper density, and placed to crystallize; it affords, on cooling, the sulphate of copper, in fine crystals.

We thus see, that we can operate in those refining establishments, which are constructed on the improved method, with much less labour, and loss in nitre, acid, earthen vessels, crucibles, charcoal, &c.; that we refine in much less time, and also obtain a greater quantity of vendible products; as, besides the gold and silver, we have likewise the crystallized sulphate of copper; we also use the least possible quantity of sulphuric acid, and the copper employed is chiefly that which formed the alloy of the ingot submitted to the refining process. We may likewise add, that this process occasions the disengagement of no other gas than the sulphureous, and a little sulphuric acid, reduced to vapour; and thus the refinery enjoys the advantage of being easily ventilated, and, of course, the workmen are better enabled to execute their operations.

On the composition of the Alloys employed by the Refiners.

The alloys which are fitted for being refined by the sulphuric acid, are those which contain only silver, gold, and copper; and which, in about a thousand parts, contain two hundred of gold. The alloy is, in general, composed as follows:

Silver	725
Gold.	200
Copper	75
	1000

We know that those alloys which contain more copper than the above proportion, hold in suspension in their solutions an anhydrous sulphate of copper, which hinders the facile separation of the gold; and also that those which contain too much gold, are not easily acted upon by the boiling sulphuric acid: the refiner should therefore always endeavour to preserve the proportions above indicated, in the alloys upon which he operates. For we know that, in general, those alloys are most readily dissolved, and with a smaller quantity of acid, which contain less copper, and more silver; and also, that it is more advantageous to operate upon those where the gold approaches nearly to the proportion indicated, viz. of two hundred parts in the thousand. We may obtain these proportions by treating those alloys, which contain more copper, with nitre; or by adding richer materials to them, such as fine silver; or else by subjecting them to cupellation. But when the alloys of gold and silver contain lead, or other easily oxidable metals, besides copper, the refiner should avoid the treating of them by means of the sulphuric acid; but should previously separate those oxidable metals, either by means of saltpetre, when they are only in small quantities, or, when in larger proportions, by refining them with the cupel. We may conclude, by observing, that the greatest benefits will result to the refiner from the accurate composition of the alloys submitted to this parting process; and that his success will depend upon the union of his chemical, commercial, and manufacturing knowledge, and their proper application.

On the Sulphuric Acid, employed in Refining the alloys of Gold and Silver.

The refiners employ the concentrated sulphuric acid, usually found in commerce, and which ordinarily marks sixty-six degrees of the areometer for acids, or has a specific gravity of 1844 degrees. They can, nevertheless, employ the acid, as it is procured from the leaden chambers, where it is made; that is to say, which marks only from forty-five to fifty degrees; but though, by so doing, they indeed save the expense of concentrating the acid, yet they thereby retard the operations of the refining, and also risk the chance of having a deposit of sulphate of lead formed upon the bottoms of their platina vessels, which, in certain cases, may occasion their destruction. The weak sulphuric acid from the leaden chambers, also contains the nitric and hydro-chloric acids, the presence of which is also injurious to the platina vessels; and we therefore advise the refiners to use no other sulphuric acid than that which marks exactly sixty-six degrees. But now we have mentioned the weak sulphuric acid, and as the sulphuric acid is employed in the large way by the refiners; so we may as well point out a resource, in case it may not be easy to procure the concentrated sulphuric acid, when we need it.

When we evaporate the acid solutions containing the sulphate of copper, and which are produced in the refining process, we obtain, after the last crystallizations, an exceedingly black sulphuric acid, and which still holds a little of the metallic substances in solution. This acid, after being concentrated in leaden boilers to about sixty degrees, and finally carried to sixty-six degrees, either in a platina boiler, or in a glass retort, furnishes a sulphuric acid nearly similar to that of commerce, and which may be well employed in place of it for the refining process. But we must observe, that as the concentration of this acid produces noxious vapours, so we should not perform it in the neighbourhood of habitations; or, at least, unless we conduct the vapours of the sulphureous acid thus produced into an apparatus where they may be neutralized by means of lime water.

We know, that in order to oxidize and dissolve one hundred parts of pure copper, we must employ about three hundred and eleven parts of sulphuric acid at sixty-six degrees; and also that it only requires ninety-one parts of this acid to oxidize and dissolve one hundred parts of fine silver; but experience has proved, that, in order to obtain clear solutions, and which should not form a mass too quickly, we must employ the sulphuric acid in a greater proportion. But, as the platina vessels are ordinarily of a small capacity, and nevertheless must serve to refine the greatest quantities possible of the matters, so we are obliged to employ that quantity of acid only, which is strictly necessary, and to supply the above want, by increasing that quantity, with particular care, at the moment of decanting the liquors. It is all these necessities which has led the refiners to adopt the proportion of acid employed by them, and which consists in using three parts of concentrated sulphuric acid, to one of the alloy, of which we have above indicated the composition; and to augment or diminish the quantity of acid according to the variations which they experience in the proportion of the gold, and also in respect to the greater or less quantity of the copper contained in the alloys which they would refine.

On the Copper which the Refiner employs to decompose the Sulphate of Silver, and to Precipitate the Silver in the Metallic state.

The refiners take care to purchase, for this use, those ingots of copper which contain some little silver, or the scraps of plated copper, or those of silvered copper, which are often to be met with in commerce at low prices; they cast the ingots into thin plates, and use these plates instead of pure copper, to decompose the sulphate of silver; the silver which is contained in the copper thus lessens the expense of the refining; and, at the same time, all the silver, as well as the copper, is made a benefit of. The only precaution they ought to take is, that they do not employ any alloys which may contain lead or tin.

It appears, that in the large way, they employ twenty-eight parts of copper to precipitate one hundred parts of silver; and that the liquors produced in this operation generally furnish from one hundred to one hundred and four parts of crystallized sulphate of copper.

On the Water which should be employed in the Refining Works.

The water which the refiner employs in his operations, should always be as pure as possible, and ought never to contain any alkaline hydro-chlorates, as then a portion of the silver would be converted into an insoluble chlorate of silver, which would render the washing of the gold difficult, and might occasion great losses. We would advise him, in this case, to employ water alkalized with ammonia, and to make the last washings of the gold, injured by the chlorate of silver, with a sufficiently large quantity of it. The refiner should always have recourse to rain-water, or at least to the purest water which he can procure in the vicinity of his establishment; he ought always to examine it, in the case of being only able to procure water from wells loaded with hydro-chlorates; and it would be greatly to his interest to purify the water, by means of the sulphate of silver, before using it to effect the solution of the sulphates of copper and silver, and the washing of the gold powder obtained in the operation of parting.

On the Combustibles employed by the Refiner.

The combustibles which answer best for heating the platina boilers, are either coke, or pure pit-coal. He should take care that the coke is prepared from pit-coal, which does not yield any sulphuric acid, and leaves the least possible quantities of ashes or earthy matters after combustion. Coke may also be used in preference to charcoal for the melting furnaces. As for the evaporating boilers, they may be heated by any combustible which can be most readily procured. We may here observe, that the coke procured from the gas-works is always the product of pit-coal of the first quality, and is perfectly adapted to the purposes of refining; but as experience has proved, that this coke burns with more difficulty than that prepared by the old methods, so it is necessary to have the power of creating at will a more rapid current of air through the fireplaces of the furnaces.

On the Platina Boilers, and their preservation.

These boilers will each hold forty-two litres; they weigh eight kilogrammes and a half, and cost about 8,500 francs; they are each enclosed in an iron frame, which serves to carry them about readily, and preserves them from suffering by the shocks to which they are continually exposed. They are made better at Paris than any where else, and therefore ought to be procured from thence.

The pure gold, at the moment it is separated from the alloy by means of the sulphuric acid, is in the state of a very fine powder, and is always found in contact with the platina, under the influence of the boiling acid, which dissolves the other two metals, and the temperature is raised considerably in consequence. The gold adheres to the bottom of the boiler, and covers it more and more continually; the preservation of this utensil, and the economizing of the combustibles, obliges us repeatedly ro remove this gold, and which is done by passing frequently into the boiler a weak *aqua-regia,* which shall dissolve the gold, without acting upon the platina. This is a very delicate operation, and the refiner should well study all the necessary circumstances, before practising it on a large scale. We are convinced that it would be much better to substitute the action of mercury, or that of the alkaline hydro-sulphurets, for the aqua-regia; but having made but few experiments upon the subject, we would advise the assayer to apply these two solvents upon a small scale only at first.

It is principally the employment of platina vessels in the refining processes, which has led to the great extension of these processes in France. But, unfortunately, the present scarcity and dearness of platina greatly limit their use. We have been informed that this inconvenience has been felt in Germany, and that they have supplied the want of platina, by an alloy, composed of one part of gold, and three parts of silver. We are ignorant whether the vessels made of this alloy, can well resist the action of concentrated and boiling sulphuric acid; but we have reason to doubt it, and think it would be better to manufacture the boilers from an alloy containing a greater proportion of gold; and especially, as the gold in powder attaches itself still more readily to these alloys of gold and silver, than to the vessels made of platina. We feel that this object is highly important; and we cannot too strongly urge the refiners to occupy themselves thereon.

We shall finish what we have to say concerning these platina boilers, by strongly recommending that they are never brought into contact with lead or tin, whilst they contain the boiling sulphuric acid; as these metals readily form alloys with platina, when it is elevated to a high temperature, and might thus occasion the destruction of the boilers, and as we have experienced within these few years.

On the Sulphate of Copper, manufactured in the Refining Works.

The refiners thus employing copper, to decompose the sulphate of silver formed in their operations, they hereby obtain and vend considerable quantities of sulphate of copper, which is a salt of low value, and in some places will hardly sell for the value of the copper it contains. Having frequently essayed the sulphate of copper obtained from the refiners, I have found iron, sometimes tin, more frequently sulphate of lime, and almost always a great excess of acid in it; these foreign substances injure nearly all the processes, in which sulphate of copper is employed; it is therefore important for the refiners never to sell this salt, before they have brought it to the necessary degree of purity. They may easily attain this end, by dissolving the impure crystals of sulphate of copper in water, and treating the solution when cold, either with the oxide of copper in scales, or with the native carbonate of copper, which is found at Chezy, near Lyons.

On the Waste or Refuse of the Refinery Works.

These residuums, known in the commerce of gold and silver under the name of *ashes*, are principally composed of the earth of crucibles, which, after having been used, are ground to a coarse powder, in order to separate as much as is possible, the grains of metal which they contain, by sifting and washing them; they also add to these the dust of the work-shops, the ashes from the melting furnaces, the soot of these furnaces; and, in a word, all the other refuse of similar works, which may contain any particles of gold or silver. These *ashes*, after having been carefully sifted and washed, are, at present, triturated repeatedly with mercury, in the way of amalgamation, in order to extract those grains of metal which had escaped the washing; and these are lastly melted, either in a forge, or in a reverberatory furnace, mixed with proper fluxes, in order to separate those portions of the precious metals, which by being either in the state of oxides, or vitrified, had thus escaped all the other modes of treatment, of which we have above spoken, and to which all the ashes had been subjected, before fusing them. Now we think, that this work might be greatly improved: in fact, since we are at last obliged to operate by fusing the ashes, in order to separate that portion of the gold and silver which we find in the oxided or vitrified state; why may we not fuse these ashes, immediately after washing them, and without treating them with mercury? We may thus obtain, at a single operation, all the precious metals which we now procure, by means of two or three amalgamations, and the subsequent fusion; it is indeed probable that a great economy would result from this simple mode of operating. It is only to the low price of the ashes, that we can at present attribute the great benefits, which have, without doubt, for a long time attended the working of them; as the difficulty of making an essay, renders it impossible to set a just value upon them. But the high prices of the substances which they employ as fluxes, and the losses which must necessarily attend their processes, are great reductions of their profits. Many of these processes may now be dispensed with, and the loss in gold and silver to a considerable amount occasioned thereby, and in spite of all the care they can take, will no longer exist, when industry shall have fully developed the organization of the new processes; and we may now therefore hope, that, as there will be but little residuums from the refineries, so the ashes from the Directors of the Mint, from the gold-workers, the jewellers, the gilders, &c., may be treated by processes more speedy and economical than those hitherto employed. We have studied this subject for some years past, and the application of salt of soda, of the sulphate of soda, and of the oxide of iron, as fluxes, have afforded good results in the small way. We shall not, however, insist much upon these ideas, since we know that men highly capable of undertaking the work, are at this moment applying in the large way, processes, in which they act a part. We shall only anticipate a remarkable improvement in the French industry, in ameliorating an important part of the art of refining; and which will, no doubt, contribute to render those works more lucrative, in which gold and silver are employed; as well as also to diminish the prices of those products to which these labours give birth.

(To be continued.)

LIV—*Experiments made by M. Lagerhjelmn, on determining the Elasticity, Ductility, and Strength of Bar-Iron, made by Rolling or Forging it.*

M. Lagerhjelmn, a Swedish engineer of mines, made a number of comparative experiments at Stockholm, in the year 1826, on the strength of bar-iron, formed either by rolling or forging it.

These results were published at Stockholm, in June, 1827, in a work, consisting of two volumes.

The 1st volume contains a description of the apparatus employed, the various modes of making the experiments;

and of the formulas, which served to calculate the different numbers upon, which gave the measures and limits of the elasticity, the ductility, &c. of the iron bars.

The 2nd volume is a complete detail of the results of these experiments.

M. Lagerhjelmn subjected the bars of iron to four series of experiments, viz. bending, twisting, oscillation, and extension.

The principal results are the following:

1st. The rollers always gave the similar bars of iron, a uniform density. But the forge-hammer produced iron of variable densities, and often containing flaws.

2nd. The rollers never twisted the fibres of the iron as sometimes happened under the forge-hammer.

It appeared that iron which was brittle on one side of the bar, and soft on the other, was extended by the rollers, without the position of these different qualities being deranged.

3rd. The measure of elasticity was the same, whether the bars were formed by rolling or hammering them.

But the limit of elasticity (which is measured by the greatest weight that the bar can support, without experiencing any permanent change in its form) was greater in those bars of forged iron, not fagotted, than in those formed by rolling, and not fagotting them.

Nevertheless, the limit of elasticity was the same for the fagotted bars, whether formed by rolling or hammering them; indeed the limit of elasticity was always greater in the fagotted iron, than in that not so treated.

4th. The rollers give the iron more ductility than the forge-hammer.

5th. The cohesion appears to be independent of the methods employed in forming the bars.

6th. The lengthening and shortening (which appear, according to the experiments, to follow the same law) were not proportional to the forces which stretched or compressed the bar of iron in the direction of its length.

7th. The elasticity experiences no change by heating and quenching the bars.

8th. It required very different forces to produce the same permanent change of form, in brittle or soft iron.

9th. The limit of ductility was the quantity which a foot in length of bar-iron was elongated, whilst its state of elasticity remained unaltered, until the moment of its rupture; the most ductile iron, on experiment, gave as the limit of its ductility, 0.27 of its primitive length, and 0.722 of its primitive section.

10th. The cohesion was the same in brittle and soft iron, and whether fibrous or not.

11th. The volume of the iron bars was augmented, in proportion as they were stretched; and the specific gravity of the broken surface was nearly 0.01 less than that of the same bar before it was stretched.

12th. When the bar was stretched until it broke, it became heated. The development of the heat was greater in the soft iron than in the brittle.

Sometimes there appeared a bright spark at the moment of rupture.

LV.—*On Diseased Cattle, and Bad Meat.* *By Mr.* CHARLES WHITLAW.

Patent Medicated Vapour Bath Establishment,
No. 14, Finsbury Place South, London, Oct. 14, 1829.

DEAR SIR,

PERMIT me, through the medium of your valuable work, to call the attention of the public to a subject which deeply involves the health of the community: I allude to the present diseased state of cattle, and more especially of sheep. Since I brought the subject before the public, in a work entitled, "New Medical Discoveries, &c.," I have endeavoured to ascertain the nature of the diseases among cattle in various parts of the kingdom; and find, that the principal disease is occasioned by a creature commonly called the flook, which brings on a mortality amongst horses, cattle, and particularly sheep, beyond all other diseases put together.

It were indeed useless to call the attention of the public to this matter, were it not in our power to afford relief and cure. It is the benevolent aim of a certain society, to prevent distress among the brute creation, by the adoption of measures whereby the cruelty of drovers and butchers is prevented; but let me tell these humane gentlemen, that the evil lies much deeper than any thing which has yet come under their notice; for we find that the greater number of the sheep that have been slaughtered for the London market, have been hurried up to London to prevent their dying a natural death! Let the society contemplate the pain which the poor animals must endure, when labouring under a diseased liver or lungs, overloaded with fat, and with their feet tender. They are driven to market perhaps one or two hundred miles, and then through the streets of London. After which, they are slaughtered, in all the heat of fever, and then served out to the inhabitants of London, and particularly among the poor, producing disease among those who eat of them, against the prohibition contained in the laws of God, as delivered to the Jews, and which are full of wisdom and compassion, and evince the care of a Father over the human family.

Now to the causes of the diseases in cattle whereof we treat. They are produced by the bad policy of our farmers in top-dressing the pasture land with recent manure, filled with all manner of poisonous seeds and roots, particularly the buttercup, poppy, and spurge, three plants highly destructive to the health of animals, and likewise also to the health of those who eat of them. The impropriety of top-dressing the fields, and allowing the cattle to pasture on them, will be at once obvious to the reflecting mind. An ox will destroy more grass with his feet, and the superfluous quantity of it which he eats, than would be sufficient to feed at least three oxen, if the manure had been properly prepared and ploughed in, for raising grass and hay, and the cattle then fed from the scythe, and which is continually done in Holland, Switzerland, and over the greater part of China. Recent manure will always impart an unwholesome and disgusting quality to grass, and which is communicated to butter, milk, and the flesh of the animals that feed on it; and from its stimulating power on the intestines of the animals, it makes them eat three times more than is necessary to their proper nourishment. A large ox will void nearly a wheelbarrow full of manure in twenty-four hours, which must point out to men of common observation, that the policy is not good; thus we see heaps of manure literally covering half the field over, and not a quarter of the nourishment could have been extracted from the food that has passed through him. The cattle will continue to eat between the heaps of dung, until they can pick up no more sweet grass; when they will begin to feed on the grass produced from their own dung; which must be disgusting to their nature, and is revolting to ours, even admitting the grass to be of the best sorts. But when we reflect that these poisonous plants are naturally fostered and rendered more acrid by the manure, and are then eaten by the cattle, and produce the diseases abovementioned, their effects are terrible indeed, both to animals and man!

How is this evil to be removed? There is no country so abundantly furnished as ours is with chalk, marle, and lime, which destroy the seeds and vegetable substances, and neutralize the most noxious properties of poisonous plants; and are so necessary to renovate poor soils, and to fertilize soils that undergo a regular cropping. "But," say our landlords, "the animals will not eat the poisonous plants above named, the wet weather is the cause of disease amongst them; and the sheep are not diseased on dry lands." Neither of which assertions are true; for at the present time four-fifths of the sheep are diseased, and certainly not more than one-fifth of our flocks are reared on swampy land. A most intelligent butcher, who served his apprenticeship to the trade, when on a visit to Wales this summer, took every pains to ascertain whether the disease existed in that country; and the result of his inquiries was, that no sheep were affected with the flook or the rot, when the land had not been top-dressed. In the county of East Lothian, Scotland, there is no such thing as the flook or rotten sheep, except in the fall of the year.

I have had an interview with a gentleman who has made an extensive tour in the county of Berwick. He informs me, that top-dressing the land with recent manure is never practised in that county. When the land is top-dressed, it is done with compost, prepared with lime and earth, and particularly with carbonaceous earth; and when sown with proper grass, the produce from such top-dressing is eagerly eaten by the cattle, and affords the best milk and butter; and the flook and the rot in cattle and sheep is never to be met with, except in low marshy lands. The land owners in the country are draining and reclaiming the swamps, and sowing them with proper grass, which will put an end to the flook and rot in that county. Another important end is also gained by so doing, it having put a stop to the fever and ague, so prevalent in former years. Not a fifth of the misery and disease exist there, which is met with in many counties in England, where such a miserable agricultural policy is pursued. There are likewise other diseases existing among the sheep, to a considerable extent, all over the kingdom, which are produced by the lactescent or milky plants, particularly the euphorbia, or spurge, so frequently to be met with in the stubble and clover fields, especially among the second crops of clover. Among the ignorant and slovenly farmers, where the ground has not been properly cleaned before sowing, lactescent plants are found growing in the greatest profusion, most of which are poisonous in their nature, and hurtful both to animals and man; and, from my experience and observation, I have found them, even when eaten by animals in very moderate quantities, to produce water on the brain, and consumption in the lungs of the sheep; and if eaten to a considerable extent, even to produce immediate death. I have frequently opened these sheep, and found the spurge and other lactescent plants to have been the cause of their death, from their corrosive action on the stomach and intestines, producing a high degree of inflammation and ulceration. They will frequently swell up suddenly after eating much of these plants, which has been frequently ascribed to the clover, but which is not the fact; for if the farmers would observe the second crop of clover, they would find myriads of poisonous plants amongst it, and which never fail to produce the disorders abovementioned.

I have every reason to suppose that the larva of the flook is to be found on the buttercup. Linnæus supposes it may probably exist in the water, but as a large portion of the sheep are exempt from it, although they feed in swamps, where such plants do not exist; and many of the sheep that feed on high lands are afflicted with it, where those plants are growing, and where swampy water is never drank, this consequently cannot be the cause of the malady: and one thing is certain, that the flook thrives exceedingly while sheep pasture on the buttercup, and generates its young in the summer months: they acquire their full size in autumn, but if the weather be very dry, the insect does not come to maturity, but frequently dies; but if, on the contrary, it be a wet fall, and an abundance of buttercups spring up, they become strong, and riot on the liver of the sheep to such a degree, as to cause them to become like a rotten apple. These sheep make little or no lean flesh, but are overloaded with a diseased acrid fat. Such is the state of the sheep, at the present moment, in many of the arable lands in England. In the mountainous districts, and many of the old deer parks and downs in England, where the abovenamed plants do not grow, we have the most healthy sheep, and the mutton is proverbially good.

There is no reason why most part of the pasture land in England should not produce equally healthy beef and mutton, if the land were properly cultivated, and sown with good grass. In proof of the correct view which I have taken of the subject, I will give the opinions of a few of the most eminent men, for a period of two thousand years, pointing out the pernicious effects of the abovementioned plants, from the time of Hypocrates and Dioscorides to the present time. Dr. Biglow, of Boston, in America, in his Medical Botany, observes, that since the time of Dioscorides, the acrid and stimulating properties of the Ranunculi have been well known. This acrimony resides in all the species, with the exception of *R. auricomus*, which is said to be mild, and perhaps two or three others. It is so powerful, that it speedily inflames or corrodes the lips and tongue, if kept in contact with them. In the nostrils it acts as a violent sternutatory; and if swallowed in considerable quantity, it brings on great pain, heat, and inflammation of the stomach, and has even occasioned convulsions and death.

Of the *ranunculus flammula*, Murray asserts, that a woman had a gangene of the arm, in consequence of having applied this plant close to the wrist; it made such havoc, that the tendons and bone were laid bare. "It is well known," observes Orfila, "that whole flocks have perished, from grazing in the spring in pastures where this plant was common. The *ranunculus bulbosa, ficaria, tora, arvenses*, &c., indeed all the species are poisonous, with the one exception mentioned by Biglow. From the foregoing facts, it may be concluded, first, that these different species of ranunculi, and their extracts, produce a severe inflammation of the texture to which they are applied; secondly, that death arising from them, is the consequence of their sympathetic action on the nervous system. 'Tragus says, that "a bit of this tuberous root when put to a tooth that aches, or into a hollow tooth, will remove the pain." Some authors say, that it breaks those teeth that are hollow, or causes them to fall out. Dr. Salmon, physician to Queen Anne, in his Family Herbal, when pointing out the effects of the crowfoot, or buttercup, observes, "They may be applied externally, but none of them should be used inwardly, being but little better than poison, by reason of their ulcerating property." But the most extensive history and investigation, pointing out the destructive effects of the ranunculus, is that of Krapf, published in Vienna, 1766; and among the old practitioners who have recorded instances of its poisonous properties, are Baglivi, Storck, Sennertius, Vanswieten, Tissot, Chesman, Withering, Pulteney, Curtis, Dodonus, Gerrard, Baron Haller, Le Noble, and many more of the most eminent men, whose names adorn the pages of medical science. But I shall conclude with an extract from Linnæus, whose authority I am certain no man will attempt to call in question, as the whole of his writings on this subject were deduced from practical observations and experiments, made before a class of the most celebrated students and physicians that ever emanated from a seminary of learning. In Linnæus's Natural History of the Sheep, the genus, species, and varieties are described; many phisiological observations are interspersed; a list of those plants are given which the sheep does not eat, amounting (from the experiments of the *Pan Suecus*) to upwards of 140 species; some are pointed out that are particularly grateful, of which number are the sheep's fescue grass *(festuca ovina)* and the shepherd's purse *(thlaspa bursa pastoris)*: and there is also an enumeration of such as are highly noxious and poisonous to this animal—as the corn horsetail *(equisetum arvense)*, spear wort *(ranunculus flammula)*, Lancashire asphodel *(anthericum ossifragum)*, mouse-ear scorpion grass (*mysolis scorpiodes*), wood anemone (*anemone nemerosa*), and dogs Mercury (*Mercurialis perennis.*)

I think that I cannot do better than refer the reader to an able letter of Dr. Nicholls, in the fourth volume of "The Philosophical Transactions," page 247.

Although the cause of the evil is not pointed out, yet the disease itself is well described, with a correct engraving of the flook. He there observes, that "it is the property of this flook always to build a wall of stone for its defence, which wall is ramified like the gall duct, within which it is framed. This stony tube, when completed, blocks up all the gall duct, and stops the passage of the gall, which thereby surcharging the duct, and dilating the orifices of the lymphatics, returns again into the blood, and gives the yellow tint to the eyes, which is the first symptom of this disease, and generally precedes the swelling of the belly."

I shall now point out the best method of eradicating the cause of so many evils, which can be most effectually done by ploughing up the fields, particularly our meadows and lowlands, as moist and swampy lands render poisonous plants more acid and corrosive. It is absolutely necessary to drain them, and to take two or three summer crops; then to fallow the land, and give it a good coat of lime or compost made with lime and earth. The lime will effectually destroy most of the insects; and if the land is properly sown with the white, red, and yellow clover, the various species of agrostis, best suited to the soil, particularly the *agrostis decumbens,* commonly known by the name of bent grass; also the *festuca poa,* meadow grass, and sweet vernal grass, all of which are well suited for wet land. If Romney Marsh was cultivated and sown with the above plants, instead of sending so many diseased sheep and cattle annually to the London market, they would not send one; nearly all the animals fattened on that marsh are so diseased, as to render them unfit for human food. An agriculturist called on me a few days ago, and used every argument in his power to prove that Romney Marsh was the best place in the kingdom for feeding bullocks, having so large a supply of buttercups. He also confessed that he had known whole droves of Scotch and Welch sheep die in a fortnight when sent to that celebrated place, one of the best cautions to the butchers not to allow sheep imported from

Scotland, or Wales, to be pastured in fields where the buttercup abounds, as it is sure to bring on the most active inflammation in a few days. As all marsh water is filled with a great variety of insects, nothing will so effectually destroy them as lime, which the farmer can do at pleasure, and thus secure his sheep and cattle from sustaining any injury by drinking it. Another important method consists in collecting all the liquor that comes from the dung-heap into a reservoir, and mixing it with lime, and watering the grass-fields with it, as we do the streets in London with water in the summer season; it would answer the double purpose of killing the insects and fertilizing the soil. Strong lime-water will answer the above purpose, or rolling the pasture-fields with a heavy cast iron roller, which will kill most of the insects. Another important method would be to employ the poor in clearing out the rich soil from the ditches, and compost it with lime; it will destroy the poisonous seeds and insects, and afford the most valuable manure for the wheat fields. The increase of wheat would more than compensate the farmer for the expense in preparing it, and by that means a harbour for insects and weeds would be destroyed, and the country also be greatly benefitted by the superior quality and increase in quantity of the grain, besides employment for many of the poor.

There is another method, and perhaps a better, than any I have before mentioned, for destroying the weeds and insects, and also for increasing the quantity, and improving the quality, of grain and grass; and that is, by trenching the land where it will bear it; for when fields have been long cultivated and cropped, they become diseased and sour, where lime has not been employed as manure; and when the grass fields have been top-dressed with recently putrefied vegetable and animal manure, the evil is greatly increased, as it not only makes the grain and grass unwholesome, but fills the fields with innumerable insects, that puncture the straw, and deposit their eggs within it, and which has, in many instances, destroyed whole crops, and brought pestilence and famine into the country. Trenching the land has not only the effect of burying the noxious weeds and insects, but it allows the earth to resuscitate itself, so that at the end of seven years it may be again retrenched, in order to undergo its routine of cropping for the seven following years, by which means it will yield a much superior grain, and more than double the quantity it now produces. But it may be asked, how is all this to be accomplished? to which I answer, that the money annually expended on the support of paupers, would of itself be sufficient; and at the same time it would employ them to some useful purpose, in effecting so desirable an object. Were such a policy to be pursued, the burdens of the poor would no longer sap the foundations of their circumscribed wealth, for they would have an abundant supply of the necessaries of life, which with them is almost the only consideration. During my travels in North America, I paid considerable attention to the natural productions of the soil, and their effects on the animal economy. Prior to the establishment of the Boards of Health in the various cities of the Union, great quantities of diseased butcher's meat and other food were brought to market; which, when eaten, produced the most malignant fevers. These spread like a pestilence through all ranks, and until the cities were completely deserted. But by the establishment of those Boards, the evil was only partially remedied. I was frequently consulted by members of the boards on the best means of preventing and curing the alarming fevers in question, and was one of the first who pointed out the diseased qualities of the food and water as being the principal cause. The majority of the boards being of the same opinion, they obtained an act of the legislature, to seize and condemn all articles of food and liquors, that were in any way adulterated; and to deprive those of their licences who attempted to sell them. They also appointed inspectors in every butcher's market in the city, with authority to throw into the rivers, all the meat that appeared in the least unsound; and subjected those selling it clandestinely, to fine and imprisonment. Thus the American farmer seeing that nothing but sound provisions would find a market, was necessarily compelled to look to the produce of his farm, and to discover remedies, that might prevent the disorders among his cattle, whether arising from poisonous weeds or insects. Numerous experiments were made, and poisons of every description resorted to, many of which brought on worse disorders than those which they were endeavouring to cure. I tried every thing I could suggest, but without success, until I used salt; this had the desired effect, as well as lime-water. Also the American *Arbor-Vitæ,* given internally, and the expressed juice of the common elder applied externally, either by itself or mixed with tar, protected the stock from the attacks of flies and other insects. The method adopted by the American farmer is, to give the sheep, cattle, and horses, salt once a week, particularly in the spring and summer months, when they are liable to swallow insects with their food; as it is a well known fact, that numbers of insects will germinate within them, producing diseases in the cattle as well as in those persons who eat them. The animals are so fond of salt when accustomed to eat it, that it is only necessary to lay the dry salt in a trough, when they will eagerly lick it up. In this country, where the sheep are not in the habit of eating it, it will be necessary to mix it with meal, or bran, until they become accustomed to its use. In the spring and summer, when the flook is breeding its young, the sheep and cattle ought to fast all night, and the salt be given to them in the morning, two or three times a week. It will not only destroy the flook, but greatly improve the quality of the meat. At this season of the year, when the flook is full grown, it will be necessary to drench the animals with lime water twice a week. The best method of preparing the lime water is, to fill a thirty-two-gallon cask full of water, and add to it ten pounds of quick-lime; as soon as the effervescence is over, it should be bunged up tightly, in order to prevent as much as possible the admission of air, and the barrel rolled five or six times, so as to mix the lime and water well by agitation. As soon as it is clear, it may be used, which will generally take place after twenty-four hours. It will keep good for any length of time, provided it be excluded from the air, and should be used immediately it is drawn off. The farmer should provide himself with half a dozen syringes, capable of holding half a pint each, bent at the neck, and having a small flexible tube, nine inches in length, attached to it by a screw, so as to render it air tight; a gag is to be put into the mouth of the sheep, with a hole in its centre; sufficiently large to prevent the animal biting the tube, which is to be put through the hole, and passed into the pharynx or gullet of the sheep, and the contents of the syringe be then injected into the stomach. Two men will drench forty sheep in an hour. The *arbor-vitæ* is one of the most powerful vermifuges, and may be given to sheep, cattle, and horses, that are not with young; it is most effectual in destroying the botts in horses, and almost every other insect. The leaves and young shoots are to be pounded in a mortar, with a small quantity of water; the juice is then to be pressed out, and half a pint given to each sheep. A quart should be given to a horse, or cow, on an empty stomach, once in three months, as a preventative; and when the animal is badly diseased, a quart should be given three times a week. Mr. Davis, a butcher, at Bayswater, lately purchased a number of sheep diseased with the flook, in order that I might try my remedies, and the result, which has hitherto proved satisfactory, shall be given to your readers, in another paper. I have to observe, that it is my principal aim, at present, to point out the cure and the means of eradicating the flook, without reference to the way by which it may pass into the liver; but should my time permit, I hope to be able to explain that also, in a very satisfactory manner.

I remain, dear sir,
Yours, &c.
CHARLES WHITLAW.

To THOMAS GILL, *Esq.*

LVI.—*On Preventing the Gaseous Constituents of Sparkling Liquors from Escaping, in Bottling them. By Mr.* STEEN ANDERSON BILLE, *of New York, U. S.*

THIS invention consists in performing the operation of drawing off any sparkling liquor, such as malt liquor, or cider, from one or more vessels, and filling one or more vessels with it; and also in closing it up firmly in such vessels, by means of corks, plugs, or stoppers of any kind; the whole being kept under *an artificial pressure,* by means of compressed air, corresponding with, or in some measure exceeding, the sparkling power of the liquor in question; and thereby preserving such sparkling power unimpaired, as well as its clearness (both being the result of repose and pressure), notwithstanding the drawing off and bottling of the same.

To effect this, an air-chamber is constructed, sufficiently strong to retain the air, when compressed to any degree required; and also sufficiently spacious to allow the whole operation above stated to be performed within it.

It having been fully ascertained, by the use of diving-bells, that the lungs of men are not affected, in any manner injurious to health, by breathing air, for a limited time, under an artificial pressure of one or two atmospheres, in addition to the common atmospheric pressure; there can, of course, be no reasonable objection to one or more persons, as the work may require, shutting themselves up in an air-chamber of the above description; and similar in its effect upon the human frame, to that of a diving-bell descending in the water to a depth, capable of producing a similar compression of the air within it. The air in both the vessels, viz. in the diving-bell, and in the air-chamber for the drawing off and bottling the sparkling liquors, is maintained in its purity for animal breathing, by the application of a condensing air-pump; and whilst the pressure in the diving-bell is produced by, or depending upon, the depth to which the bell shall be sunk in the water, the pressure in the air-chamber for the drawing off and bottling of sparkling liquors, will be produced by the action of the air-pump; and will depend upon a relieving valve, not permitting the pressure within it to exceed the weight, by which the valve shall have been previously regulated, with a view to the contemplated operation; or, if a column of water be substituted for a valve, than the weight of such column of water; and which latter medium possesses the additional advantage, of counteracting any little variation, which a change of temperature may occasion in the expansion of the air within the vessel, by either receding from, or filling up, the space of any vessel, into which the end of the tube shall be immersed.

If the fermented liquor to be operated upon be placed in an air-chamber of this description, in open vessels, it is evident that the development of the carbonic acid, or rather the escape of it in the form of gas, will, by the pressure of the compressed air contained in the chamber, be as effectually prevented, for the extent of such pressure, as if the liquor were kept within corked bottles. On the contrary, as far as the chemical energy of the fermented liquor, in forming carbonic acid, and emitting it in the shape of gas, exceeds this pressure of the compressed air, intended for its suppression, the gas will naturally escape; this, however, is so far from being a disadvantage, that it actually is a most desirable circumstance, as affording the means of relieving the liquor from any excess of expansive force; which, otherwise, might endanger the vessels intended for its preservation. And thus the sparkling power of the liquor may be governed and controlled at pleasure, as well with a view to its safety in keeping, as to its fitness for a beverage.

When the liquor shall have been kept a sufficient length of time under pressure in the air-chamber, to have acquired the sparkling quality required, either by fermentation, or some other chemical process, it may be drawn off into bottles, and corked, perfectly clear (leaving the sediment in the vat), and highly sparkling; and as ready for immediate use, as though it had been kept all the while in bottles, provided that such drawing off and bottling be performed in the chamber; that is to say, under the pressure, to which the liquor shall till then have been subjected. The best proof of this fact is, the flat or still appearance of any sparkling liquor, while under pressure in a bottle; and this, notwithstanding any motion be given to the liquor, by turning or upsetting the bottle in which it is contained. It may, therefore, in a similar manner, be handled without sustaining any loss whatever of its acquired qualities, in pouring it from one vessel into another; provided only, and as above stated, that the pressure be preserved during the operation.

The fermented liquor to be operated upon, is introduced into the air-chamber by means of a cylinder, placed without the chamber, horizontally, or nearly so, above the height of the vats within it, which are intended for the reception of the liquor. This cylinder is furnished with four tubes and cocks; two communicating with the air-chamber, viz. one on the top of the cylinder, communicating with the air in the chamber; and the other at the bottom of the cylinder, communicating with the spout leading to the vat within, intended for the reception of the liquor; and two other cocks communicating with the atmosphere, the one at the top with the air; and the other at the bottom, with the liquor to be introduced; and thus, by alternately shutting and opening the respective cocks, the liquor may successively be supplied to the cylinder, and emptied into the vats in the air-chamber.

For the admission of a person, to perform the operations of drawing off and bottling the liquor, a man-hole is formed in the top of the air-chamber, having a lid inside, which closes hermetically by the pressure of the air within upon it. A moveable cylinder, closed at the top, covers the person who is to enter; this cylinder is screwed air-tight to the rim or flanch of the man-hole. On opening a communication between the air-chamber and the cylinder, by means of a cock, the state of the air in both will be equalized, and the entrance through the man-hole, be thereby rendered perfectly free. On leaving the chamber the same way, the man-hole is first shut, and a communication opened between the cylinder and the atmospheric air, which will relieve the cylinder from the compressed air within the chamber, and will thus allow the cylinder to be removed, to let out the person who was shut up within it.

The bottles are introduced into the air-chamber, and again delivered out of it, through one or more boxes, which are attached to the chamber, and have a door at each end of them; the one opening into the air-chamber, and the other communicating with the atmosphere. The bottles are placed upon a moveable shelf, and are thus introduced into the box; on closing the door, and opening the cock of a tube, connected with the box and the air-chamber, the air in both will be equalized; and thus the entrance into the air-chamber be rendered free. By reversing the operation, the shelf, with its bottles, may in a similar manner be let out. If two boxes be made use of, some saving may be made in the expenditure of the compressed air at this operation, by equalizing the air in both the boxes, the one for letting in, and the other for letting out the bottles, before any new communication is opened, either with the air-chamber, or with the atmosphere, as the case may be.

The application of four boxes would be still better, with a view to dispatch, in the receiving, filling, corking, and delivering of the bottles out. If the liquor is to be drawn off into vessels larger than the bottles, as barrels or casks for instance, such vessels necessarily being perfectly tight and strong, are to be placed near to the air-chamber, from which two pipes are made to communicate with the top of the vessel, by two corresponding holes and sockets, or flanches in the vessel; the one for equalizing the air in both, and the other for drawing off the liquor from the vats in the air chamber; and thus, by turning the respective cocks, the above operation may be performed at pleasure.

To prevent any mustiness forming on the top of the liquor, contained in the vats in the air-chamber, in consequence of a more extended surface of the liquor being placed in contact with the air in this way, than when closed up in bottles; but still more with a view to the air in the air-chamber being constantly renewed, for the sake of respiration, the surface of the liquor ought to be covered with a floating lid, or top-piece, leaving only a trifling space open around its edge, to prevent it from sticking to the vat; and this small space may be still further closed up, by some liquid lighter than the liquor in the vat, such as sweet oil, which is not easily affected by the air, not liable to mix itself with the liquor.

With a view to the safety of the person entering the air-chamber, a pliable tube may be attached to the opening inside, through which the air is forced into the air-chamber by the air-pump, which must necessarily be kept at work, when any person is employed in the chamber; and which tube, when taken up by the person, or only placed near to him, will infallibly secure to him a current of fresh air, abundantly sufficient for his respiration; besides which, the whole air in the chamber may, occasionally, be renewed for the same purpose; and even before his entering the chamber, the actual state of the air in it may be fully ascertained by means of cocks, communicating with the interior of it; and indeed, if required, a general purification of it may be effected by the air-pump. If an additional air-pump be likewise applied, for the extraction of the air from the lower part of the chamber, which will be the carbonic acid gas, as being the heaviest; whilst, at the same time, atmospheric air is forced into the upper part of it, in the same proportion; the connection of both pumps with a fly-wheel, will reduce the power required for the latter operation, leaving only the friction to be overcome;

and will thus facilitate the purification of the air within the chamber to such a degree, as to admit of it being constantly kept as pure as the air without it, and this, whatever may be the size of the chamber. Light is best admitted into the chamber, by reflection from the outside of it, in order to avoid any inconvenience arising from the direct application of lamps within it.

To shorten the time necessary for any person to remain in the air-chamber, it is desirable that such improvements in the drawing off, and the bottling and corking, of the liquors should be adopted, as will facilitate these operations as much as possible.

With regard to the construction of the air-chamber, strength and tightness constitute the qualities indispensably required ; these may be obtained in different ways ; but it is presumed to be the cheapest plan, to give to the air-chamber a circular shape, by which the two sides are made to form, as it were, one cylinder within another, and kept together by square frames of beams, placed vertically, at suitable distances, radiating, as if from a common centre, and enclosing, at the same time, both the top and the bottom ; while the whole is lined with planks, forming an entire box, to be covered internally, with some substance fit to render the chamber air-tight, such as zinc, or lead, in sheets. If the width or height be too great for the frames to sustain the pressure from within, bars of iron may be supplied, in support of the middle of the beams; by thus connecting the cross-beams of the opposite sides, as well as those of the top and bottom, and which will not materially interfere with the application of the space within the chamber, to its intended purposes.

When the air-chamber shall be duly protected from the variations of temperature of the external air, the temperature of the air within it may be kept pretty uniform, or at any degree required, by suffering the air, on entering the chamber, to pass either through a cooling or a heating vessel, as the case may require.

Although several advantages, as above stated, will result from the application of an air-chamber, to the purpose of keeping quantities of liquor under pressure, in order to keep them clear and sparkling; yet the inventor does not claim such advantages, generally, as his discovery; but confines himself, in his claim of invention, to the drawing off and corking up of sparkling liquors, *under pressure*, by means of an air chamber, containing air, compressed to any degree required; and whereby the clearness and sparkling quality of the liquor, previously acquired, either in the air-chamber, or elsewhere, will be preserved; notwithstanding the drawing off, bottling, and corking of the same.

LVII.—*On the form in which Silex is deposited in the Stems of Straw. By the* EDITOR.

ACCIDENT is frequently the parent of Discovery, and so it has proved in the present instance. It has long been known that silex entered into the component parts of straw, and that, when exposed to the powerful action of the blow-pipe, a stem of it might be melted into a bead of glass; but in what particular part of the stem it was deposited, or in what shape it was formed, have hitherto been unknown.

The attention of the Editor was called to some beautiful plaited straw, which had formed an expensive bonnet, but was now undergoing a change of shape. It was a Vandyke plait, in a band of half an inch in breadth, and was possessed of a most splendid brilliancy. A few days afterwards, upon lighting his kitchen fire, the person so doing was very much surprised at finding an incombustible fibrous matter in the ashes of the grate, and which still preserved its figure, resembling that of a feather, in spite of all she could do, in urging the heat of the fire, by means of the bellows. Upon this she called the attention of the Editor to so singular an appearance; and on his looking at it attentively, he recollected the form of the straw plait, still remaining in the crossing of the fibres in these ashes. Accordingly, he extracted them from the fire with some care, to avoid breaking them, and placed them under his microscope, when he had the satisfaction to discover, that the siliceous matter formed *distinct slender threads, or fibres,* running through the stems, and was evidently secreted by vessels, destined for this particular office; and that it was not promiscuously mingled with the other parts of the stems. Most probably, it occasioned the peculiarly brilliant appearance of this straw plait, from its having been deposited upon its external part. This discovery was not made sufficiently early in the month, to enable the Editor to introduce a figure of this singular appearance of the silex in the straw, in the plate accompanying this present number; but it will form one of the figures in the next plate.

The Editor has since repeated the incineration of this straw plait, with the same result; and, in the case of not exposing it to so high a temperature, the carbon still remaining in it; the straw retained its original organization, and showed the air-cells, and other curious parts of its structure, to great advantage under the microscope.

LVIII.—*On Substituting Plates of Fusible Metal, for Wood-Blocks, in Calico-Printing, &c. By M. G.* ENGELMANN[*].

THE engraving of wood-blocks for calico-printing is very expensive, and these blocks being also formed of an hygrometric substance, are continually subject to change, from swelling and shrinking by the effects of moisture and dryness, and thus occasion a considerable loss of time, and give false impressions, from the trouble of replacing them, and the consequent inequality in their adjustments. I have therefore endeavoured to substitute for them a substance which is not liable to swell by the action of humidity, and can be moulded with great accuracy; and at the same time is also capable of resisting the effects of the blows of the mallet, and of the acids contained in certain of the colours used in calico-printing. The fusible alloy appears to me to offer these advantages, and I employ the process of *clichage* in its application.

---

[*] From *Bullet. de la Soc. Indust. de Muhlhausen;* and Ferussac's *Bulletin des Sciences Technologiques.*

I operate in the following manner;—having made an engraving in wood, on a piece of plank, and given a sufficient breadth to the bottoms of the lines, to enable them to part from the mould, I interpose between the metal and the wood a substance, which shall facilitate their separation; and therefore I brush over the engraving a mixture of *sanguine* (red-chalk), ground in water. I then finally affix the engraved block to the bottom of the upright slide or stem of the stamp, and let it fall suddenly upon the melted fusible alloy, at the moment when it is just upon the point of becoming solid, or has acquired a *pasty* consistence; I thus obtain a counter-proof of the engraving. This counter-proof serves as the matrix or mould for the engraved plates of fusible metal which I intend to make. For this purpose, I affix it upon a piece of wood, and surround it with a border of metal, intended to determine the thickness of the metal plates struck in it; and which border is also formed in such a manner, as that whether placed on one side or the other, it shall exactly fit; I then firmly affix this matrix, thus surrounded with its frame, upon the bottom of the stem of the stamp, and strike another counter-proof *en cliche;* and so proceed, until I have thus produced enough of them to compose and to cover a calico-printing-block.

These second counter-proofs, thus obtained, I place, with their engraved faces undermost, the one by the side of the other, upon a flat surface; and also shape and dispose them with the necessary regularity, to ensure precision in the impressions from them. I then pass a heated iron along the joints, in order to solder one piece to another; and then fix the whole upon a wooden plank, by means of copper nails; but I previously varnish the plank, to prevent moisture from penetrating it. These blocks, if I may judge from the two experiments which I have made with them, offer no other inconvenience than being a little heavier than those made entirely with wood: they differ however but little from those blocks in which the raised parts are made with brass or copper; a difference, comparatively trifling, in comparison with the great advantages they possess, in not being liable to change from the action of moisture.

It is easy to see, that a calico-printing block, thus constructed, must cost much less, than one engraved upon wood; and especially, as we need only to engrave a fragment, or one of the parts, which are usually repeated a great number of times; and to multiply them by the *clichage*, an operation which will produce in less than an hour, more casts than are sufficient to fill a block, thickly covered with them! The value of the metal employed, and which need not be more than a line in thickness, is a mere trifle; and, after the block has done its work, may be remelted. We can preserve the small matrices, which occupy but little room, and when we require to make another block, it can be done quickly. It is also equally easy, in changing a moulded pattern, to vary the position of these small casts; since we can either bring them near together, or remove them to a distance apart; place them in a line, or mingle one piece with another; and thus either form them into borders, or employ them in the interior parts of the prints.

If we compare the price of these blocks, with those whose raised parts are formed of brass or copper, it is much more in their favour; and we have no doubt that in the hands of skilful persons, the art of forming them by means of *clichage*, may obtain as great perfection as those blocks possess.

Remarks by the EDITOR.

We believe that the covering of calico-printing blocks with metal raised parts, either stereotyped, or struck *en cliche*, is already patented in this country.

We gave in Vol. II. pages 279, and 321, of our *Technical Repository*, an account of the method of striking the medallion, termed by the French *en cliche*, and also an explanatory plate of the stamp, and the method of forming the frames or borders around the matrixes; and to which we must refer our readers.

LIX.—*On Improvements in Extracting Gelatine from Bones. By M. A.* DE PUYMAURIN, *Director of the Royal Mint at Paris.*

THE first apparatus, constructed according to the principles of M. D'Arcet, was intended to furnish gelatinous solutions for the *Hospital de la Charité*, at Paris.

This apparatus would, however, only furnish gelatine dissolved in water. This solution was then poured into the boilers belonging to the cooking establishment of the hospital, to undergo the other necessary preparations. An apparatus of this kind was therefore insufficient for the use to which I intended to apply it. The gelatine dissolved in the water could not be employed by the workmen in the Mint: it presented great difficulties, both in converting it into *bouillon*, and in using it for the preparation of ragouts; it would have required a great number of particular cooking vessels, as well as the necessary knowledge, and also have occasioned a great loss of time. The ends which I proposed to obtain in my apparatus were, that it might equally serve for the preparation of the aliments, as for the extraction of the gelatine from the bones. It was also desirable that it should not require any attendance, nor particular care; and that its operation should be as regular in the night as by day. I thus employed in its construction all the resources offered by our acquired knowledge, as well to attain the highest degree of perfection, as to prevent every kind of accident. I thus hoped to fulfil the task I had imposed upon myself; but, no doubt, my first essays are destined to receive some slight modifications. The publicity which I hereby give to them, will not, however, be without utility.

The first apparatus which I constructed was a portable one, and of a cylindrical form. I have since finished a second, because I thought that it was desirable to have a double set of steam-boilers, in order that their service might experience no interruption; the consequences of which would have been most unfortunate, as the result would have been, to bring the workmen back to their old habits again; and I should thus have lost all the benefit of my efforts, and the great sacrifices which I have made, to give them new and better ones.

The two sets of apparatus are nearly alike ~~in their~~ details; the only difference being in the shape of their boilers, occasioned by the situations in which they are placed. The circular form has the advantage of affording more strength, and of permitting us to diminish their thickness; the best proportion for boilers of this form, is to make them four times the length of their diameter.

It may be objected, that the caloric radiates from these boilers; but I think that this inconvenience is more than compensated for, by their other advantages.

My apparatus is composed of an enclosure of plate-iron or masonry; of a steam-boiler, and of a much smaller boiler enclosed within the steam-boiler, to which it forms a cover, and serves for either a water-bath, or a steam-bath; of a *marmite,* for cooking the aliments, with its cover; of a tube for distributing the steam; of six cylinders; of a float; and of a machine to break and crush the bones.

The furnace, whether formed of plate-iron, or of masonry, is conveniently pierced with openings to admit the different parts of the apparatus. The steam-boiler is of a thickness proportioned to its form, to the pressure which it is to bear, and to the nature of the metal of which it is formed.

The smaller boiler is lodged within it, and, as before stated, forms a cover to it: this second boiler is intended to receive within it, either a water-bath, or a steam-bath : it is strongly united to the border of the steam-boiler by pressing screws. The marmite, for cooking the aliments, is made of tinned iron, its cover being furnished with strong ears and hinges; it will cook the aliments in different ways; viz. either by steam, when no water is to be put into it, but the steam is introduced through a cock; as an ordinary marmite; or as a water-bath, or a steam-bath; or lastly, in a bath of heated air. The cover of the marmite is also made of tinned iron, its inner border is garnished with cloth, which renders it elastic, and capable of supporting the pressure of a mounting of iron: this cover is enveloped in wool. The gelatine is extracted from the bones in the other cylinders, two of which are of double the capacity of the four others, and may thus be considered as equal in capacity to those four. It is well to have four cylinders, as at the end of twenty-five or twenty-six hours, the bones will be entirely exhausted of their nutritive principles.

I renew the bones in the cylinders, alternately, every twenty-four hours, and mingle the solutions obtained, and thus procure a solution always alike. The small cylinders are constructed upon the proportions which are found most advantageous for the condensation of the steam; they are heated by the great cylinder, the steam from which is conveyed in leaden worm-pipes surrounding the lower parts of them; the water condensed in them, heated by means of the quantity of caloric which is lost, is returned into the boiler, and thus actuates and regulates the progress of the work, and diminishes the consumption of the fuel: the upper parts of the cylinders are also surrounded with other leaden worm-pipes, supplied with water, and which escapes by cocks, and may be employed for any uses of cookery. The fire-place should be sufficiently large to contain enough fuel to serve during the night: the quantity of steam to be produced will serve to calculate its size. The float serves to maintain a constant level of the water in the boilers. A glass tube, with its mountings, is employed, to indicate the height of the water in each boiler. A regulator for the fire, constructed upon the principle of *Bonnemain*, is placed either in the boiler, or the fire-place; and in the case of the rectangular boiler, it is posited horizontally at the bottom of the boiler, which much simplifies it, and by permitting us to dispense with a stuffing-box, augments the sensibility of the instrument. I have placed a valve in the chimney, as well as in the iron pipe which leads the air to the fire-place of the furnace, and both of which are actuated by the *Bonnemain's regulator*, and thus obviate any accidents which might injure the accuracy of this instrument.

I break the bones in a box, placed under the screw of a fly-press, used in coining. But other motive powers might be used, capable of producing a strong impression.

It is highly important that the bones should be broken into small fragments. This preparation accelerates and facilitates the extraction of the gelatine. In those establishments, however, where there is no machine for breaking the bones, an anvil, and a mallet armed with iron, may be used; or the mallet may be mounted on the end of a lever, which may be actuated in the manner of a forge-hammer. We should, however, surround the anvil with a casing of sheet-iron, to prevent the bits of bone from being scattered around. We might also break the bones between toothed and channelled cylinders. We must, in general, avoid the production of heat, from blows too quickly repeated, lest the bones might contract a taste of empyreuma; and they should also be wetted during the operation.

I have besides added to this apparatus other contrivances, which ought always to be applied to steam-boilers, such as safety-valves; valves disposed in such a manner, as in case of sudden cooling taking place, to permit the entrance of air into the boiler, and hinder the formation of a vacuum, which might cause the gelatine to rise into the marmite. Also *roundels* of *fusible metal,* which should melt when the temperature was too much elevated; and lastly, *manometers,* for indicating the pressure of the steam in the boilers.

LX.—*On Improvements in the Manufacture of Horn and Tortoise-shell Combs. By the* EDITOR.

THE Editor has long known, that *two large-toothed* tortoise-shell combs could be made out of *one* piece of tortoise-shell; the interstices in the one, furnishing the material to form the teeth in the other, and *vice-versa:* but he had no idea of the possibility of cutting two *fine-toothed* combs out of one piece; this is, however, now effected in the following manner:—The thin plate of tortoise-shell being softened by heat, a fine and properly shaped chisel is passed through it, in such a manner, as to divide it into the teeth, and the spaces between them, but without removing or cutting away any of the substance of the tortoise-shell; and thus the two combs can be formed, with great economy, out of this very expensive material.

Another great saving, in the same costly material, has likewise been effected by a German comb-maker, settled in this country; who forms the solid broad part of the large-toothed combs, now so generally worn by the ladies, out of tortoise-shell; but their teeth are made in a plate of horn, *soldered* by means of heat to the tortoise-shell; and that in so dexterous a manner, that although the place of the joining was pointed out to the Editor, yet he was unable to distinguish any difference there, between that and the other parts of the comb. The veined or clouded appearance of tortoise-shell, was given to the horn, in the usual manner, by means of oxide of lead, and quicklime, or orpiment; and so ably was this managed, that it greatly contributed to hide the juncture of the horn and tortoise-shell from being perceived.

Our English comb-makers also tinge or dye their horn-combs in the above manner; but they very soon assume a dull appearance, owing to the lead in the dye becoming revived, and putting on its usual metallic appearance. Now the dyed combs, made by the German, have a most beautiful polish, which continues for a length of time unimpaired; so that it would seem that they had been coated or defended by a varnish. It is by no means improbable, that the French, or rather German polish, or varnish, composed of shell-lac spirit-varnish, applied by the aid of oil, has been used to defend the combs, and give them the beautiful polish above-mentioned.

The Editor is indebted to Mr. Robert Hendrie, an extensive manufacturing perfumer, in Tichborne Street, for pointing out these improvements in comb-making to his notice.

LXI. — *On Preparing Hartshorn Jelly, and Blanc-Manger*[*].

The process of M. Ferrez, and which we have repeated with good success, consists in steeping four (French) ounces of shavings or raspings of hartshorn, for ten minutes, in eight ounces of water, acidulated with a *gros* (the eighth-part of an ounce) of muriatic acid (in order to dissolve the earthy parts of it); it must then be well washed, in two or three waters, in order to remove the soluble salts which are formed, and which would otherwise injure the transparency of the jelly, and oblige us to clarify it with the whites of eggs.

The hartshorn, thus washed, is then to be boiled for half an hour, in a new portion of water. This short space of time is sufficient to extract the gelatine which it may contain. It must then be strongly-pressed through a linen cloth, whilst hot, to filtre it.

---

[*] From the *Journal de Pharmacie*. 1828.

On afterwards adding to this jelly the requisite quantities of sugar, and other ingredients, we shall obtain, after a slight ebullition and cooling, a perfectly transparent jelly, like that made from isinglass, and equally fit for making *blanc-manger*, by the addition of milk.

LXII.—*Additional Particulars on Transferring Prints to the surface of Wood. By the* EDITOR.

IN our last number, page 244, we gave an Article upon this subject, from the *Journal de la Societé du Bas. Rhin;* since then, Mr. Robert Hendrie has informed us, that the process may be effected with much less trouble than in the manner there stated; and even in so simple a mode, that ladies are now in the habit of decorating their articles made of varnished wood, with lithographic and other prints. We shall endeavour to obtain some particulars of this simplified process. In the mean time, we have to add to our former Article, that we think it would much facilitate the work, were the paper upon which the print is made, to be moistened with a caustic lie; and which would not only prevent the spirit-varnish from penetrating into the paper, but would also soften the printing-ink, and cause it to apply itself more readily upon the varnished surface of the wood.

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since September 30, 1829.

To John Moore, of Broad Weir, in the city of Bristol, gentlemen; for certain new or improved machinery for propelling carriages; also for propelling ships, vessels, or other floating bodies, and for guiding propelled carriages; and also apparatus for condensing the steam of the steam-engine, after it has propelled the steam-engine piston. Dated September 30, 1829.—To be specified in six months.

To William Rodger, of Norfolk-street, Strand, in the county of Middlesex, lieutenant in the royal navy; for certain improvements in the construction of cat-head stoppers. Dated September 30, 1829.—In six months.

To Thomas Banks, of Patrick's Croft, within Barton upon Irwell, in the county of Lancaster, civil engineer; for certain improvements in steam-engines. Dated September 30, 1829.—In six months.

To Paul Descroizilles, of Fenchurch-street, in the city of London, chemist; for certain improvements in apparatus for removing the down from cotton, and certain other fabrics, by singing. Dated October 7, 1829.—In six months.

To William Church, of Heywood-house, near Birmingham, in the county of Warwick, Esq.; for certain improvements in machines for propelling vessels, and other machines, capable of being propelled by steam; and in boilers, applicable to the same, and also to other purposes. Dated October 15, 1829.—In six months.

To William Church, of Heywood-house, near Birmingham, in the county of Warwick, Esq.; for certain improvements in or upon instruments for sharpening knives and other edge tools; and in the machinery or apparatus for manufacturing the same. Dated October 15, 1829.—In six months.

GILL'S
TECHNOLOGICAL & MICROSCOPIC REPOSITORY.

LXIII.—*On the late Dr.* William Hyde Wollaston's *Microscopic Doublet.*

WITH A FIGURE.

We extract the account of this instrument from the Philosophical Transactions, for 1829.

" In the illumination of microscopic objects, whatever light is collected and brought to the eye, beyond that which is fully commanded by the object-glasses, tends rather to impede than to assist distinct vision.

" My endeavour has been, to collect as much of the admitted light as can be done by simple means, to a focus in the same plane as the object to be examined. For this purpose, I have used, with success, a plane mirror to direct the light, and a plano-convex lens to collect it, the plane side of the lens being towards the object to be illuminated.

" With respect to the apparatus for magnifying, notwithstanding the great improvements lately made in the construction of microscopes, by the introduction of achromatic object-glasses, and the manifest superiority they possess over any single microscope, in the greater extent of field they present to view at once, whereby they are admirably adapted to make an entertaining exhibition of known objects; yet hardly any one of the compound microscopes which I have yet seen, is capable of exhibiting minute bodies with that extreme distinctness which is to be obtained by more simple means; and which is absolutely necessary for an original examination of unknown objects.

" My experience has led me to prefer a lens of a plano-convex form, even when made of glass; but the sapphire lens of this form, recently introduced into use by Mr. Pritchard, has a decided superiority over every single lens hitherto employed.

"The cost, however, of such a lens, in comparison with glass, as well as the readiness with which any number and variety of the latter kind can be procured, led me to consider what simple combinations of them might perhaps equal the sapphire lens in performance, without great cost or difficulty of construction. And though both Mr. Herschel and Professor Airy have recently applied their superior talents to the analytical investigation of this subject; it seemed not improbable, that the more humble efforts of a mere experimentalist, might be rewarded by some useful results.

"The consideration of that form of eye-piece for astronomical telescopes called Huygenian, suggested the probability, that a similar combination should have a similar advantage, of correcting both chromatic and spherical aberration, if employed in an opposite direction, as a microscope.

"The construction which I found convenient in my trials, consists of two tubes, fitted one within the other by screwing, and each perforated at the extremity. By this construction, two suitable plano-convex lenses, fixed in these perforations, may, because of their plane surfaces, have their axes easily placed in the same line; and their distance from each other may be so varied, by screwing, as to produce the best effects of which they are susceptible.

"As far as my trials have hitherto gone, I am led to consider the proportion of three to one as nearly the best, for the relation of the foci of these lenses; and their joint performance to be the most perfect, when the distance between their plane surfaces is about one and four-tenths of the shorter focus. But as all the lenses I possess are not similar segments of spheres, or of the same relative thickness, I could not expect exact uniformity in the results.

"The following is a description of the apparatus which I have employed.

" In plate VI. fig. 1 represents a brass tube, about six inches long, and of such a diameter, as to preclude any reflection of false light from its sides; and the better to insure this, the inside of the tube should be blackened. At the top of the tube, or within it, at a small distance from the top, is placed either a plano-convex lens U T, or one properly crossed, so as to have the least aberration, about three-quarters of an inch focus, and having its plane side next to the object to be viewed; and at the bottom, is a circular perforation A, of about three-tenths of an inch diameter, for limiting the light reflected from the plane mirror R, and which is to be brought to a focus at *a*, giving a neat image of the perforation A at a distance of about eight-tenths of an inch from the lens U T, and in the same plane as the object which is to be examined. The length of the tube, and the distance of the convex lens from the perforation, may be somewhat varied. The length here given, six inches, being that which it was thought would be most convenient for the height of the eye of the observer above the table. The diameter of the image of the perforation A need not, excepting with lower powers than are here meant to be considered, exceed one-twentieth of an inch.

" The intensity of illumination will depend upon the diameter of the illuminating lens, and the proportion of the image to the perforation, and may be regulated according to the wish of the observer.

" The compound magnifier M, consists, as before-mentioned, of two plano-convex lenses; the proportion of the foci of these lenses being about as three to one. They are fixed in their cells, having their plane sides next to the object to be viewed, their plane surfaces being distant from each other about one and four-tenths, or one and a half, of the length of the shorter focus. This distance should be varied by trial, until the utmost possible degree of distinctness has been attained, not only in the centre, but throughout the whole field of view.

"In order to determine the distance between the plane surfaces of the lenses, I have used the following contrivance. A wire is bent so as to form a spring, to the ends of which two small pieces of plate glass are attached. Between the surfaces of the pieces of glass, is placed the interior cell, or that which carries the lens of the longer focus; and the distance between the exterior surfaces of the pieces of glass is to be measured with a pair of callipers: the cell is then to be screwed into its place, and the compound cell subjected to the same operation; when the increase of distance between the exterior surfaces of the pieces of glass will evidently be equal to the distance between the plane surfaces of the lenses.

"The exterior cell of the compound magnifier should be formed with a flanch, so that it may rest upon the piece that receives it. This is a far more convenient method than screwing, and the magnifiers can be more readily changed.

"The lens U T, or the perforation A, should have an adjustment, by which the distance between them may be varied, and the image of the perforation be thus brought into the same plane as the object to be examined. This may perhaps be most conveniently done by two tubes, screwing the one into the other.

"A stage, for carrying the objects, furnished with the requisite means for lateral adjustments, is fixed at *a*, between the magnifier and the lens U T. The adjustment for distinct vision, is applied to the piece carrying the compound magnifier.

"For the perfect performance of this microscope, it is necessary that the axes of the lenses, and the centre of the perforation A, should be in the same right line. This may be known by the image of the perforation being illuminated throughout its whole extent, and having its whole circumference equally well defined. For illumination at night, a common bull's-eye lanthorn may be used with great advantage.

“ With this microscopic doublet, I have seen the finest striæ and serratures upon the scales of the *lepisma* and *podura*, and the scales upon a gnat's wing, with a degree of delicate perspicuity, which I have in vain sought in any other microscope with which I am acquainted.

“ Before I conclude, I would point out one great advantage that has confirmed me in the preference I have given to the use of a plano-convex lens, properly applied; that is, having its plane side next to the object: namely, that if such a lens should touch a fluid under examination, the view is not only not impaired, but even improved, by the contact of the two media; but if a double convex lens be used, and it should accidentally touch the fluid, which not unfrequently happens, when the lens is of short focus, there is an end of the examination, until the lens has been taken out, wiped, and replaced.”

“ *London, October 28, 1828.*”

“ *Appendix.*

“ The instrument which has been described, will, of course, admit of many varieties of form; I shall, however, add a description of that which has appeared to me to be convenient, and which is represented in plate VI. fig. 1. A brass tube, of sufficient length and diameter, forms the body of the instrument; one end of the tube is closed by a piece having a screw S, by means of which it may be fixed in the top of the box intended to contain the instrument, and which thus forms a support for it. A portion of the tube above this piece is cut open in front for the purpose of admitting light to the small plane mirror R, which is attached to an horizontal axis, passing through the diameter of the tube. The inclination of this mirror may be varied, by means of a milled head, fixed to the axis on the outside of the tube; the other adjustment at right-angles being made, by turning the box of the microscope.

“ Into the tube, above the opening, a conical piece E B is soldered, into which is screwed a small cylindrical tube, carrying the perforation A, before described. The plano-convex lens U T, is fixed in a spring tube, which slides into that which forms the body of the microscope. The position, consequently, of the lens may be varied, so as to bring the image of the perforation into the same plane with the object to be viewed. A piece of plate glass, about two inches square, or less if it be thought more convenient, is attached to the top of the tube, and serves to support a stage, having lateral adjustments at right-angles to each other. The piece into which the magnifiers fit, may be moved by a rack and pinion, and great care must be taken to arrange this adjustment, so that the magnifier may move precisely in the prolongation of the axis of the tube. The tube is divided into two pieces of equal lengths, which screw into each other at the middle; and which, when taken asunder, will allow of the whole instrument being packed in a box, about four inches square.

" Supposing the plano-convex lens to be placed at its proper distance from the stage, the image of the perforation may be readily brought into the same plane with the object, by fixing temporarily a small wire across the perforation, with a bit of wax; viewing any object placed upon a piece of glass upon the stage of the microscope, and varying the distance of the perforation from the lens, by screwing its tube, until the image of the wire is seen distinctly at the same time with the object upon the piece of glass."

Remarks. By the EDITOR.

Notwithstanding Dr. Wollaston has mounted the plano-convex lens U T in a spring tube, and mentions that the position of it may be varied; yet he has described no means of effecting that variation. Now, in the instrument which was shown the Editor, by the kindness of Mr. Children, as mentioned in our fourth volume, page 196, this lens was adjusted by means of two upright slits, formed in the sides of the tube, and through which two pins passed, from the sliding spring tube, with milled heads upon their external ends; and thus the observer was enabled to vary the light at pleasure.

LXIV.—*On the Microscope. By* THOMAS CARPENTER, *Esq. With Remarks and Additions. By the* EDITOR.

WITH FIGURES.

DEAR SIR, *London, November 10th, 1829.*

LAST summer I was walking in the grounds at the back of Chandos House, in Southgate, and on my approaching a small fir-tree, growing close to the summer-house, near the bank of the New River, I found it occupied by thousands of flies, of the genus *musca;* and on again passing the tree, towards the evening of the same day, I was again induced to examine it, and was astonished at the number of these flies which had assembled there, and had taken up their quarters for their night's repose. There were myriads of them; every part of every branch was covered with them. On the ground under the tree, I found several dead ones, some of which I took home, and dissected their various parts, which furnished me with many interesting subjects for my microscope. Some of these preparations I placed between slips of glass, which I send you, with one of the flies, for your inspection. Among them you will find many curious and singular characters, particularly in a small portion, taken from the body of this fly; which, minute as it is, yet contains one of the finest anatomical displays of the large arterial vessels, branching off in various directions; and other vessels, so exceedingly minute, as almost to escape the sight, even when assisted by the most powerful lens of my microscope. And between the same glasses, are scales from the thorax of one of the cabbage-butterflies, which are excellent test objects.

I found in a ditch, in the same grounds, which was nearly dry, a vast quantity of tad-poles, which had congregated together, in consequence of the water evaporating and leaving only a small quantity in a hollow space, in the bottom of the ditch. Many of these tad-poles were exhausted, and in a dying state; some of them I took home, and having put them into boiling water, in order to put an end to their sufferings, I proceeded to examine their tails, and could very plainly perceive the ramifications of the large and small blood vessels, containing the globules of blood, which remained stationary within the vessels at the time when the animals died. Some of these tails I have placed between talc and glass sliders; and, on examining them under your microscope, you will observe hundreds of these vessels, meandering in various directions, throughout the tails, with numerous globules of the blood within them.

On my examining some small gnats, which I had obtained in fine preservation, I found that very few of the scales on their wings had been disturbed or removed; I therefore placed them between slips of glass for your acceptance. Two or three specimens of these gnats I found covered over with such a profusion of various scales, on every part of them, that it was really astonishing! Their proboscis was also studded over with some exceedingly minute ones, and which were marked with most delicate lines, some of which I also send. You will also observe the sheath of the proboscis, from which I took them; it having partially come away, and left exposed those darts, and other instruments, with which this insect makes such sharp attacks on our persons, in order to extract the blood. I endeavoured to display these instruments, which are several in number; but, from the circumstance of the insects being in a dry state, they were so brittle as to prevent my effecting it. Yet there is, even in this mutilated state, enough left to show the construction of these instruments, and their adaptation for piercing the skin, and sucking up the blood. As soon as I can procure some of these insects in a proper state for the purpose, I will endeavour to furnish you with a set of them, displayed in a more finished manner; as the scales above mentioned are excellent test objects.

I send with them another glass slider, containing a few scales taken from the *lepisma saccharina.* Many of these you will find similar to those you have given a figure of in plate II. vol. IV. But there are also many others of a different shape, and whose lines or markings are so difficult to make out, that none of the usually constructed microscopes will show them. Yet they are distinctly made out under Mr. Tulley's combined achromatic object glass, of a deeper focus than the one he has lent me; that indeed will bring them out, but not so sharp and well defined as the one he has lately constructed, and whose focal distance, I understand from him, is under three-tenths of an inch.

I also send you a slider, fitted up by the late Dr. Letsom; between which, he stated there is placed a portion of the crystalline humour of the haddock's eye, on a micrometer. This is an excellent test object, and requires a good object glass to bring out its fine and curious characters.

I had lately sent me from the country, a bottle, which together with many others, a gentleman had filled with a sweet liquid, and hung on his wall-fruit trees, for the purpose of destroying the wasps, which at that season of the year generally laid his best wall-fruit under contribution. Into this bottle hundreds of hornets, wasps, and various other insects, had entered, attracted by the sweets within it; and, like many other marauding adventurers, had met with a speedy death. In examining these various insects, there appeared to me many parts of them that, by a careful dissection or separation, I might appropriate as very excellent objects for my microscope. I therefore proceeded to work on them, and now send you a part of the result of my labours.

The heads of several of the hornets, I have displayed on pins, with their formidable jaws set open, in order to show their tongue, palpi, and other apparatus attached. Some are placed with the upper, and others with the under, side of their heads uppermost, in order that they may be examined with more facility. The tongue I observed to be a most singular and beautiful organ, composed of strong muscular bands, and fringed with curiously formed cups on stems. In addition to which, there are four minute globular sponges, like balls, of an orange colour, situated at various distances, round the edge of the tongue. The compound eyes, and the three stemmata, are also very fine objects. But these fall infinitely short of the fine workmanship displayed in the various parts of the tongue! One or two of the tongues I have taken out and placed between two slips of glass, pressed quite close together, in order to show their fine muscular structure, together with the cups or suckers with which the border of the tongue is fringed. But it is in vain for me to attempt to do justice to the complex workmanship of this organ, by any description of mine. You must see it under the microscope, in order to judge of its exquisite finishings; and for which purpose, I have prepared them, both as opaque and transparent objects; but the most favourable view of this organ would be whilst in a moist state, as many of the very fine parts shrivel up in drying.

I have also placed two pair of the mandibles, on a piece of card, to enable you to examine those parts of the insect, and in which you will perceive great strength, and much beauty.

Between other slips of glass, you will find several stings from the hornets, dissected; some of the darts are taken out from the sheath; others are partly drawn forth, showing in what manner they lay within it, and the mode in which the insect protrudes them when in the act of stinging. The stings are barbed or serrated similar to those of wasps or bees. Some of the poison bags I have also pressed flat between the same glasses, both in order to show their muscular structure, and also to spread some of the poison over the surface of the glass, in order to examine its component parts; these I find to be exceedingly minute sharp particles, containing powerfully acid salts, and some of which have formed very curious crystallizations, many of them of a star like figure. Between this glass are also portions of the palpi, in which are very fine characters.

I found that I had pressed these poison-bags of the hornets, rather too close between the glass slips for their structure to be properly examined; and therefore I have placed between other glasses, various stings, and the poison-bags attached to them, from the abdomens of wasps; and which are yet pressed sufficiently close to give you a very correct view of the muscular structure of the poison-bags of these insects.

In the same bottle I also found a couple of small moths, the proboscis of which I observed was composed of two parts; these parts I separated, and placed them between slips of glass. You will find much to admire in the construction of these organs, and particularly a most delicate fringe, with which they are adorned. In the same glass slips is likewise the dissected sting of a large wild bee, found among the other insects: and I also send the dissected apparatus, which was contained in the mouth of this bee; this is a most interesting opaque object, showing the instruments used by this insect in collecting the farina from the flowers, &c., and particularly the beautiful structure of its tongue, which may be traced for its whole length, it being composed of ring-like appendages, or muscles, to enable the insect to lengthen or shorten this organ. There were also, in the bottle, many smaller bees, and from which I have made dissections of their proboscis, stings, eyes, &c. These preparations I have placed between talc sliders, which I now send. I also found three species of the genus *tabanus*, whose tongues I dissected; and having taken out from each tongue or trunk six instruments, I have placed them between talcs, in an ivory slider; and in which you will also find the dissected proboscis of a gnat; the dissected proboscis of a species of *rhingia*; and the sting and poison-bag of a hornet. And in other ivory sliders, you will find the dissected stings and eyes of the wasp; a dissected eye of a small beetle; and the wings of various midge flies.

In dissecting one of the wasps, I met with a very singular and complicated organ, within its abdomen, and the structure of which is really astonishing! As such, I send it for your examination; and also a similar constructed organ taken from the body of the wild bee just mentioned; together with two other organs equally curious, and which I took from the abdomens of a couple of the long legged shepherd spiders. One of these I have placed within a talc slider; the other is placed on a pin, to be viewed as an opaque object. In the same talc slider is also a fine dissection of part of the eyes of the common house-fly, made by the *termes pulsatorium*, or smaller death-watch.

I likewise send you an insect of very singular appearance; it possesses numerous eyes, which are placed in a very curious manner, and can only be used by the insect to look downwards and sideways, the head being enclosed in a kind of cap, or a large broad shield covering, which protects the head and eyes from any injury coming from above. The whole of the underside is curiously granulated. This insect deserves your particular inspection; it is the male glow-worm, and with it you will receive a female specimen; and as they are curious and interesting, I send you a few particulars respecting them. They are generally seen during the summer months, from June till the close of August, if the season be mild, on dry banks, about woods, pastures, and hedges, exhibiting, as soon as the dusk of the evening commences, the most vivid and beautiful phosphoric splendour, in the form of a round spot, of considerable size. The animal itself, which is the female insect, measures about three quarters of an inch in length, and is of a dull earthy brown colour on the upper parts, and beneath, more or less tinged with rose colour, with the two or three of the last joints of the body of a pale or whitish sulphur colour. It is from these last mentioned parts that the phosphoric light above-mentioned proceeds, and which is of a yellow colour, with a very slight cast of green. The body, exclusive of the thorax, consists of ten joints or divisions. The larva, pupa, and complete female insect, scarcely differ perceptibly from each other in general appearance; but the phosphoric light is strongest in the complete insect.

It is a slow moving insect, and in its manner of walking frequently seems to drag itself on by starts, or slight efforts, as it were. The male is smaller than the female, and is provided both with wings and wing cases; it is but rarely seen; and it seems, even at present, not very clearly determined whether it be luminous or not. The general idea among naturalists has been, that it is not; and that the splendour exhibited by the female in this species, is ordained for the purpose of attracting the male; and accordingly, she can withdraw or display this light at pleasure, by contracting or unfolding her body. When crushed with the hand, this luminous substance of the glow-worm adheres to it, and continues to shine till it is dried up. But the insect may be kept alive, if properly supplied with moist turf, grass, moss, &c., for a considerable length of time, and as soon as the evening commences, will regularly exhibit its beautiful effulgence, illuminating every object within a small space around it; and sometimes the light is so vivid, as to be perceived through the box in which it is kept. When a glow-worm is put into a phial, and the phial is immersed in water, a very beautiful irradiation will be found to take place. This insect deposits its eggs, which are small and yellowish, on the leaves of grass, &c.

"Accompanied with the foregoing objects, I send you various specimens of moss, some of which you will find very interesting under the microscope. It may be necessary here to observe, that any leaf of moss, however dry and shrivelled up, may, by placing it in a drop of water, on a slip of glass, have all the delicate characters and reticulations displayed, as if it was a recent specimen. The mosses afford a great variety of highly interesting microscopic objects; the reticulations in some of the leaves are very delicate; and when in seed, the characters round the margin of the capsules are curious; as is also the speculums or covers of the capsules or pods. Their seeds are likewise well worth examining as microscopic objects. Among the leaves I now send, are some from *hypnum complanatum,* the identical leaf from which Dr. Goring made the drawing which he published in the Quarterly Journal for June, 1827, page 428. In another of the sliders, there are small portions of fern leaves. The glass slider contains *bryum argenteum, bryum capillari,* and *sphagnum acutifolium.* In the box slider is contained *Hookeria lucens, bryum paniculatum,* a species of *hypnum, hypnum puram,* and some bog moss; and in the glass slider, No. 526, are specimens of the moss, which Dr. Goring had described, and which was found growing on the bark of a plum-tree. In this same glass are likewise some scales taken from the *lycæna argus* butterfly, in some of which the lines are very difficult to make out; and as such, are considered excellent test objects; as is also the species of moss described by Dr. Goring, the characters in which cannot be defined without the assistance of a very excellent object glass.

I also send you a few minute beetles, of the genus *cryptophagus latridus,* and which I found among what is termed the dry rot. In taking up the floor of a kitchen, it was discovered that this evil had proceeded to such an extent, as to have destroyed every part of the timbers beneath, and also the floor itself. The appearance that presented itself was not simply that of mouldiness or fungi, but it was absolutely a complete forest of underwood, spreading all over the under surface of the floor, joists, &c., and actually making progress up the skirting and partitions of the kitchen; so that if it had not been looked into, it would in time have overrun the whole timbers in the house. To give you some idea of the plant which was making such rapid growth, I herewith send you a small portion of the timber in its decayed state, with the fibrous dry rot plant attached to and growing from it.

In conclusion, I beg to remind you, before the season is too far advanced, to procure a few species of *monoculi*, and also some of the *volvox globator*, in order that you may examine the delicate and beautiful reticulations and characters that adorn the shells containing these minute wonders in creation. I send you a few dried specimens, placed between slips of glass; but these exhibit no beauties compared with what you will observe in living specimens; as such, I have to request you will not delay making search for them, in the ponds nearest to you; the exquisite workmanship displayed in these minute specks, are manifest proofs of the power and skill of their Divine Creator! In short, the more we examine His works, the more cause we have to wonder and adore:

Range where you please, through water, earth, and air,
God is in every thing, and every where.

I remain, dear sir,
Your obliged friend,
To T. Gill, *Esq.* THOMAS CARPENTER.

Remarks and Additions. By the EDITOR.

In plate VI. fig. 2 is part of one of the darts, enclosed in the proboscis of a gnat, as described by Mr. Carpenter. It has an exceedingly sharp point, a stout back, and a finely serrated blade, covered with linear divisions for its whole length, which is at least four times as long as the part shown; and, together with the other darts and instruments, forms an assemblage which is but too well adapted for inflicting the painful wounds the gnat makes, in order to feed upon the blood. The minute scales, with which the proboscis was thickly covered, were all marked with the delicate lines mentioned by Mr. Carpenter, and were perfectly defined by the compound achromatic object glass and astronomical eye-piece of the microscope of Mr. William Tulley's construction.

Fig. 3 is part of the lamina forming the crystalline humour of the eye of a haddock, and prepared, as stated by Mr. T. Carpenter, by the late scientific Dr. John Letsom, The doctor has so managed, as to decompose this lamina into its ultimate fibres, a part of one of which is shown in our figure, as connected with a piece of the lamina, and has its edges indented, or serrated, in a similar manner to those of the lamina itself. It forms a highly interesting object, and will tend to explain the manner in which the cornea can be varied in its shape by muscular contraction and expansion; it being composed of numerous coats or layers, like those of an onion, for instance, and these coats formed of fibres, united by means of sutures, so as to allow of motion taking place amongst them.

Fig. 4 is one of the star-like arborescent crystallizations formed in the liquid ejected from the poison-bladder of a wasp. We entirely agree with Mr. T. Carpenter in his remarks upon the exquisite beauty of the muscular structure of the tongue of a hornet, and the singular cups with which its end is fringed, and which are admirably adapted to the purpose of extracting the nectar of flowers, the pulp of fruits, &c.; and indeed the entire structure of its head is well worth the attention of the microscopic observer.

Fig. 5 is part of the wing of a midge-fly, in which the beautiful arrangement of the hairs upon it will be seen.

Fig. 6 is the underside of the head of the male *lampyrus noctiluca,* or glow-worm, covered with its singular hood or shield, as described by Mr. Carpenter.

Fig. 7 is part of a leaf of the *sphagnum acutifolium;* and fig. 8, of another species of bog-moss.

Fig. 9 is part of a minute shell of a species of *monoculus,* viewed in Mr. William Tulley's achromatic microscope, in which its beautiful reticulated structure is shown. When viewed in Mr. T. Carpenter's compound microscope, it merely appeared to have round spots all over it, the angular forms of the reticulations not being visible.

Fig. 10 is part of the shell of another minute *monoculus,* in which the hexangular reticulations are seen.

Fig. 11 exhibits the appearance of several globules of the blood, viewed under a moderately magnifying power;

and fig. 12, the same, but more magnified; and in each of which a minute speck is visible. Fig. 13 represents three of the globules under a still higher power, and here each globule is shown to be surrounded with a circular rim or border. Fig. 14 represents two of the globules, as exhibited in the solar microscope, and here the rims or borders have an irregular shape. And, lastly, in fig. 15, a single globule is shown, magnified one thousand times, by the power of La Torre's spherule

In fig. 16 we have endeavoured to show the singular effect of the contractile power of the blood in curdling, as exhibited to the Editor by Mr. Lister, in his excellent Tulley's achromatic microscope. Here the globules slide one beneath another, much in the manner in which a heap of similar coins are often found to do. La Torre has likewise figured this singular effect in his Work on the Microscope, published in the year 1784.

Fig. 17 represents the form of the silex deposited in straw, as it appeared in the incinerated plaited straw, mentioned in our last number.

(To be continued.)

LXV.—*On Active Molecules. By* ROBERT BROWN, *Esq. F.R.S.*[*]

British Museum, July 28, 1829.

ABOUT twelvemonths ago, I printed an account of Microscopical Observations, made in the summer of 1827, on the Particles contained in the Pollen of Plants; and on the general Existence of active Molecules, in Organic and Inorganic Bodies.

In the present supplement to that account, my objects are, to explain and modify a few of its statements, to advert to some of the remarks that have been made, either on the correctness or originality of the observations, and to

[*] From the *Edinburgh Journal of Science.*

the causes that have been considered sufficient for the explanation of the phenomena.

In the first place, I have to notice an erroneous assertion of more than one writer, namely, that I have stated the active molecules to be animated*. This mistake has probably arisen from my having communicated the facts in the same order in which they occurred, accompanied by the views which presented themselves in the different stages of the investigation; and in one case, from my having adopted the language in referring to the opinion of another inquirer into the first branch of the subject.

Although I have endeavoured strictly to confine myself to the statement of the facts observed, yet, in speaking of the active molecules, I have not been able, in all cases, to avoid the introduction of hypothesis; for such is the supposition, that the equally active particles of greater size, and frequently of very different form, are primary compounds of these molecules, a supposition which, though professedly conjectural, I regret having so much insisted on, especially as it may seem connected with the opinion of the absolute identity of the molecules, from whatever source derived†.

On this latter point, the only two objects that I endeavoured to ascertain, were their size and figure; and although I was, upon the whole, inclined to think that in these respects the molecules were similar, from whatever substances obtained; yet the evidence then adduced in support of the supposition, was far from satisfactory; and I may add, that I am still less satisfied now, that such is the fact. But even had the uniformity of the molecules in those two points been absolutely established, it did not necessarily follow, nor have I any where stated, as has been imputed to me, that they also agreed in all their other properties and functions.

---

* This was certainly the general opinion.—EDITOR.

† We also regret this, as it seemed to countenance the exploded doctrine of *Equivocal Generation*; and this will account for our never having mentioned Mr. Brown's work.—EDITOR.

I have remarked, that certain substances, namely, sulphur, resin, and wax, did not yield active particles, which, however, proceeded merely from defective manipulation; for I have since readily obtained them from all these bodies; at the same time I ought to notice, that their existence in sulphur was previously mentioned to me by my friend Mr. Lister.

In prosecuting the inquiry, subsequent to the publication of my Observations, I have chiefly employed the simple microscope, mentioned in the pamphlet as having been made for me by Mr. Dolland, and of which the three lenses that I have generally used, are of the fortieth, sixtieth, and seventieth of an inch focus.

Many of the observations have been repeated and confirmed with other simple microscopes, having lenses of similar powers; and also with the best achromatic compound microscopes, either in my own possession, or belonging to my friends.

The result of the inquiry, at present, essentially agrees with that which may be collected from my printed account, and may be here briefly stated in the following terms, namely:

That extremely minute particles of solid matter, whether obtained from organic or inorganic substances, when suspended in pure water, or in some other aqueous fluids, exhibit motions for which I am unable to account, and which, from their irregularity, and seeming independence, resemble, in a remarkable degree, the less rapid motions of some of the simplest animalcules of infusions. That the smallest moving particles observed, and which I have termed active molecules, appear to be spherical, or nearly so, and to be between one-twenty thousandth, and one-thirty thousandth of an inch in diameter; and that other particles, of considerably greater and various size, and either of similar or of very different figure, also present analogous motions in like circumstances.

I have formerly stated my belief, that these motions of the particles neither arose from currents in the fluid containing them, nor depended on that intestine motion which may be supposed to accompany its evaporation.

These causes of motion, however, either singly, or combined with others,—as the attractions and repulsions among the particles themselves; their unstable equilibrium in the fluid in which they are suspended; their hygrometrical or capillary action; and, in some cases, the disengagement of volatile matter, or minute air bubbles,—have been considered by several writers as sufficiently accounting for the appearances. Some of the alleged causes here stated, with others, which I have considered it unnecessary to mention, are not likely to be overlooked, or to deceive observers of any experience in microscopical researches; and the insufficiency of the most important of these enumerated, may, I think, be satisfactorily shown, by means of a very simple experiment.

This experiment consists in reducing the drop of water, containing the particles of microscopic minuteness, and prolonging its existence by immersing it in a transparent fluid of inferior specific gravity, with which it is not miscible, and in which evaporation is extremely slow. If to almond oil, which is a fluid having these properties, a considerably smaller portion of water, duly impregnated with particles, be added, and the two fluids shaken or triturated together, drops of water, of various sizes, from one-fiftieth to one-two thousandth of an inch in diameter, will be immediately produced. Of these, the most minute necessarily contain but few particles, and some may be occasionally observed with one particle only. In this manner, minute drops, which, if exposed to the air, would be dissipated in less than a minute, may be retained for more than an hour. But in all the drops thus formed and protected, the motion of the particles takes place with undiminished activity; while the principal causes assigned for that motion, namely, evaporation, and their mutual attraction and repulsion, are either materially reduced, or absolutely null.

It may here be remarked, that those currents from centre to circumference, at first hardly perceptible, then more obvious, and at last very rapid, which constantly exist in drops exposed to the air, and disturb, or entirely overcome, the proper motion of the particles, are wholly prevented in drops of small size immersed in oil,—a fact which, however, is only apparent in those drops that are flatted in consequence of being nearly or absolutely in contact with the stage of the microscope.

That the motion of the particles is not produced by any cause acting on the surface of the drop, may be proved by an inversion of the experiment; for by mixing a very small proportion of oil, with the water containing the particles, microscopic drops of oil, of extreme minuteness, some of them not exceeding in size the particles themselves, will be found on the surface of the drop of water, and nearly or altogether at rest; while the particles in the centre, or towards the bottom, of the drop, continue to move with their usual degree of activity.

By means of the contrivance now described, for reducing the size, and prolonging the existence, of the drops containing the particles, which, simple as it is, did not till lately occur to me, a greater command of the subject is obtained, sufficient, perhaps, to enable us to ascertain the real cause of the motion in question.

Of the few experiments which I have made, since this manner of observing was adopted, some appear to me so curious, that I do not venture to state them until they are verified by frequent and careful repetition.

I shall conclude these supplementary remarks to my former observations, by noticing the degree in which I consider those observations to have been anticipated.

That molecular was sometimes confounded with animalcular motion, by several of the earlier microscopical observers, appears extremely probable, from various passages in the writings of Leeuwenhoek, as well as from a remarkable paper, by Stephen Gray, published in the nineteenth volume of the *Philosophical Transactions.*

Needham also, and Buffon, with whom the hypothesis of organic particles originated, seem to have not unfrequently fallen into the same mistake. And I am inclined to believe, that Spallanzani, notwithstanding one of his statements respecting them, has, under the head of *Animaletti d'ultimo ordini,* included the active molecules, as well as true animalcules.

I may next mention, that Gleichen, the discoverer of the motion of the particles of the pollen, also observed similar motions in the particles of the ovulum of Zea Mays.

Wrisberg and Muller, who adopted in part Buffon's hypothesis, state the globules, of which they suppose all organic bodies formed, to be capable of motion; and Muller distinguishes these moving organic globules, from real animalcules, with which, he observes, they have been confounded by some very respectable observers.

In 1814, Dr. James Drummond, of Belfast, published, in the seventh volume of the *Transactions of the Royal Society of Edinburgh,* a valuable paper, entitled, "*On certain appearances observed in the Dissection of the Eyes of Fishes.*"

In this essay, which I regret I was entirely unacquainted with when I printed the account of my observations, the doctor gives an account of the very remarkable motions of the spicula, which form the silvery part of the choroid coat of the eyes of fishes.

These spicula were examined with a simple microscope, and as opaque objects, a strong light being thrown upon the drop of water in which they were suspended. The appearances are minutely described, and very ingenious reasoning employed, to show that, to account for the motions, the least improbable conjecture is, to suppose the spicula animated.

As these bodies were seen by reflected, and not by transmitted, light, a very correct idea of their actual motions could hardly be obtained. And with the low magnifying powers necessarily employed with the instrument, and in the manner described, the more minute nearly spherical particles, or active molecules, which, when higher powers were used, I have constantly found in abundance along with the spicula, entirely escaped observation.

Dr. Drummond's researches were strictly limitted to the spicula of the eyes and scales of fishes; and he does not appear to have suspected that particles, having analogous motions, might exist in other organized bodies; and far less in inorganic matter. I consider myself anticipated by this acute observer, only to the same extent as by Gleichen, and in a much less degree than by Muller, whose statements have been already alluded to.

All the observers now mentioned, have confined themselves to the examination of the particles of organic bodies. In 1819, however, Mr. Bywater, of Liverpool, published an account of *Microscopical Observations*, in which it is stated, that not only organic tissues, but also inorganic substances, consist of what he terms animated or irritable particles.

A second edition of this essay appeared in 1828, probably altered in some points; but it may be supposed agreeing essentially in its statements with the edition of 1819, which I have never seen, and of the existence of which I was ignorant when I published my pamphlet.

From the edition of 1828, which I have but lately met with, it appears that Mr. Bywater employed a compound microscope, of the construction called Culpepper's; that the object was examined in a bright sunshine, and the light from the mirror thrown so obliquely on the stage, as to give a blue colour to the infusion.

The first experiment I here subjoin in his own words:—

"A small portion of flour must be placed on a slip of glass, and mixed with a drop of water, then instantly applied to the microscope; and if stirred, and viewed by a bright sun, as already described, it will appear evidently filled with innumerable small linear bodies, writhing and twisting about with extreme activity."

Similar bodies, and equally in motion, were obtained from animal and vegetable tissues, from vegetable mould, from sand-stone, after being made red hot, from coal, ashes, and other inorganic bodies.

I believe that in thus stating the manner in which Mr. Bywater's experiments were conducted, I have enabled microscopical observers to judge of the extent and kind of optical illusion to which he was liable, and of which he does not seem to have been aware. I have only to add, that it is not here a question of priority; for if his observations are to be depended on, mine must be entirely set aside.

LXVI.—*On the Rothesay Cotton-Mills; the Glasgow Bleacheries, Calico-Printing, and Dyeing Works; Crown-Glass Works; and the Carron Iron Works. By the Rev.* J. LETTICE, *B.D.**

"WHEREVER great quantities of work, or great effects, are wrought by small and simple means; or great difficulties achieved by ingenious contrivances; however common the objects, or the materials of their operations, the means of performance may be well worth attention; and where they are capable of being in some measure conveyed by verbal description, a traveller may contribute to extend their benefits. You will not suppose it is in his power, during the short time to which his notice must be confined, to discover any secret processes or mysteries which particular manufacturers may have introduced. These, as well as patented secrets, are always kept out of sight; or else strangers are not admitted where they may be discernible. But from such parts as a traveller is allowed to see, he may sometimes be able to suggest new employments, and new resources for industry, in distant regions, on his return home; such as may be wanted, and are adapted to other situations. Some benefit to the public may then be derived from that information which he can communicate, or but even hint, upon subjects of this nature. Or persons, the most indifferent to these advantages, may at least be amused with the representations of ingenious arts. But the philosopher will be delighted to find his theories in chemistry, hydrostatics, the mechanical powers, &c., more extensively reduced to practice; whilst the political economist must rejoice to see the multiplication of resources for the benefit of the community."

---

* From his Tour through Scotland, in the year 1792.

On the Rothesay Cotton-Mills, in the Isle of Bute.

" The flourishing state of Rothesay, has not solely arisen from its herring-fishery and its commerce. The establishment of cotton-mills, the effects of which have been very diffusive among the common people, has contributed to it in a degree highly worth consideration. Individuals of the lower class, able to work, need never remain unemployed; and, in fact, there is scarcely an idle person in the place. This is the first station in Scotland where a cotton-mill was projected. The undertaking was patronized by Lord Bute, and received every encouragement from him which the original adventurers judged necessary to ask. Mr. Buchanan, one of the proprietors, obligingly conducted us through the various parts of this extensive fabric. The first mill was erected about eleven years ago (i. e. in 1781), and the second is very nearly finished. The great water-wheel of the latter is twenty-four feet in diameter, and the breadth of its periphery not less than six. This wheel is really a grand object; and its dark colour, approaching to black, combined with its magnitude, and prodigious power, when in motion, impresses a sublime idea! This vast body, in its rotation, communicates movement to a horizontal beam or shaft," resembling the mast of a first rate man of war, and a hundred feet in length. Around this are fixed a great number of vertical wheels, which turn as many horizontal ones; and these again are connected with others, ranged above them, through four or five stories of the new edifice, alternately vertical and horizontal. The effect produced by this whole combination of wheels, is the ceaseless whirling of many thousand spindles, and the regular movement of all that machinery by which cotton is carded, spun, twisted, and every operation performed, till it is prepared for the loom. Five hundred persons, many of them children, are at present engaged in the mill first erected; and the second, we were told, will soon require that number to be doubled. These thousand persons, with the assistance of this powerful machinery, more simple than its vastness led me at first to conceive, are able, it is supposed, to perform the work of twenty thousand without it! The great advantage obtained in the cheapness of the whole mass of work performed, is too evident to need intimation. After reflecting on the vast sum of effects here produced by the application of the various mechanical powers, we were naturally led to contemplate the invention itself as one of the most laudable exertions of practical science, for the attainment of an object so important to society as the cheapness of work. And it was highly pleasing to observe such a number of little hands made early useful in the application and removal of the materials to and from this grand machine. Nor did it add little to the satisfaction with which we contemplated the scene, to have witnessed the appearance of health and cheerfulness in the generality of the persons engaged in it."

"As we passed along the higher grounds, we caught a view of Loch Fad, or the Long Lake, from whence issued that important stream which is the prime mover of the cotton-works above described."

On a large Bleachery near Glasgow.

"The busy scene of a large bleachery, tempted us to dismount. We were shown some capacious boiling vats, constructed of wood above, and metal below, sufficiently large to receive fifteen hundred yards of linen or cotton, which here undergo their first operation, of being boiled with soap and ashes. Contiguous to these vats, is placed the washing machinery. Several broad-headed beetles, of massive wood, or stocks, as they are called, being put into the action of hammering, by a large water-wheel, beat and press the cloths, and keep turning them on every side, whilst a rapid stream of cold water passes continually beneath them; and this process is continued till they have discharged all their impurities. They are then thrown into a great vat, filled in a few minutes with cold water, by means of copper pipes placed above it. Being thus perfectly cleared of the soap, they are removed from thence to a wringing-machine; after which, they are now entirely prepared for the bleach-field, of which there are several in this corner of Dumbartonshire, of great extent and importance.

" Those cloths which are intended to be dyed or printed, are, when taken up from the field, steeped immediately in water, having sulphuric acid mingled with it, and are then dried in spacious rooms, constructed for the purpose, with an infinity of apertures, to draw a constant current of air."

On a Calico-Printing Work at Melton.

" About a mile farther than the bleachery, on the Dumbarton road, at Melton, our curiosity was arrested by a considerable fabric, for the printing of linens and cottons. It is situated just below a huge craggy rock, from whence pours a constant and copious torrent. Belonging to this establishment, we passed a very spacious print-field, in our way to the different edifices destined to prepare the several articles which covered it. Though a print-field is all picture, nothing, perhaps, can be less picturesque. Art, ingenuity, and taste, however, here display much to commend, and something to admire. The superintendant received us with civility; and, conducting us first to a very long and spacious room, directed our attention to a brick flue, which ran lengthwise through the middle of it, from one end to the other. It resembles those which you see in hot-houses, and communicates a constant and regular heat to the whole room. On each side of the flue, tables are placed, parallel to each other, all the way down. At one end of each, next the flue, is set a colour tub. On a bed of colour, spread moist over the tearing-sieve, floating on water, the printer, one at each table, lightly and evenly presses his pattern-block, which is about a foot long, and of various widths, according to the figure of the pattern; and immediately placing it, with precision, on the linen or cotton cloth, spread out before him on the table, strikes it smartly with a mallet. Whilst he is doing this, a boy, standing ready at the tub, instantly effaces the impression which the block had left on the colour in the sieve, restoring to its surface, at each interval, a supply of fresh colour, brushed over it as smoothly as possible, and that with great quickness and address. The heat of the flue dries the colours as soon as laid on the cloth, sufficiently to prevent their running. One block impresses no more than a single colour*. When the first impression is finished, which we saw carrying on in two different rooms, each piece is removed to the dyeing-house, whither we proceeded next, and is wholly immersed, except a very small portion of one end, fixed upon a roller, and suspended across the vat. As this roller is turned about, the piece winds round it, and is thus drawn out again. The colours being now perfectly fixed, by the virtue of the drugs infused into the water of the dyeing-vat, every piece next underwent a boiling in the copper, and then a scouring in the beetle-mill, processes already described.

" A stream of warm water, from the dyeing vats, and the boilers, continually flowing off, as soon as it is done with, through different passages at the lower end of this edifice, forms two reeking cascades, whose vapour fills the air, as they roll down through their channels, on one side of the print-field, diffusing a singular effect over the whole scenery of the place.

---

* " I have since learned, that several of the operations of printing here described, are performed at Leven, in this neighbourhood, by water-machinery. Much time and expense are said to be saved by this method, where practicable. The calicoes of Leven are spoken of as almost superior to any made in Great Britain. Some persons have asserted, that the neighbourhood of London is scarcely to be excepted for its success in this particular species of manufacture."

" The pieces of cotton or linen are now laid out to bleach in the print-field, that the parts left unprinted, either in the ground, or within the figures themselves, may recover their purity and whiteness. When the pattern requires different colours, the piece is taken up, after some days, and returned to the printing-house, where the second set are stamped, and all the foregoing processes repeated; as they are after every impression of a new colour. But when the parts of any pattern are to be coloured green, the piece, after the figure has been duly printed, is sent to the pencil-room. This branch is performed by women and girls, and we saw many employed in it. The blue and yellow, whose union is to make the green required, are successively laid on by a painter's brush; the former being first suffered to dry. It was pleasing to see the rapidity, accompanied with precision, which, by force of habit, these persons had acquired in working.

" In the last place we visited the work-shop, where not less, I believe, than twenty young artists were engraving patterns upon blocks of wood. A thin plate of polished holly is laid, for this purpose, upon a block of plane-wood, properly fashioned. The blocks, when engraved, are painted of that particular colour which they are intended to impress upon the cloth. We took notice, that each of the engravers had either a newspaper or a book laid behind the block on which he was working. In this manner they occasionally relieve the intenseness of application; and we may, perhaps, conclude, that their work is paid for by quantity, and not by time.

" We understood that the pattern-drawers, retained in this establishment, chiefly pursue their business at home.

They ought to possess an inventive talent, and that is best exercised in retirement and solitude.

" The situation of this extensive establishment is very striking. In descending its declivity, which nearly fronts the south, we were delighted with a bright view of the Clyde, rolling its waves so conveniently for the exportation of the abundant products of these and many other print-fields and bleacheries in this neighbourhood, to the various regions of the earth."

On the Glass-Works at Dumbarton.

" Dumbarton has the advantage of a safe harbour; and the salmon fisheries of the Leven and the Clyde, which succeed each other in the spring and the summer, bring some business to the town. But the establishment of a glass-bottle and crown-glass manufactory, and the print-fields in the vicinity, give its chief employment, and have contributed to increase its population.

" The glass-house is very considerable, and pays an annual duty to government of nearly £4000. We obtained access to the crown-glass fabric, and were entertained with the brilliancy of the spectacle which it afforded. The strong heat, and clear lively blaze of the grand furnace, where the materials are fused, is a striking object, which will be noticed; but that which amused us most, was the continual movement of the artificers, to and from this copious reservoir, to take out the melted matter on their long iron tubes, and their action of blowing it, by which, from the appearance of a red hot coal, it assumes a globular form, and instantly becomes enlarged, hollow, and transparent. This being held a very short time within the mouth of a fiery furnace, and blown a second time, becomes a large oblate spheroid, more and more transparent, still continuing red hot. Put again into the oven, it is soon drawn forth, and blown still larger, into a perfect and magnificent globe; then opened, and whirled rapidly round four or five times upon the artist's tube, it finally expands, and ends in becoming a round flat plate, from four to five feet in diameter. Having now obtained the most beautiful transparency, it shows the fires of the furnaces, and the brilliant operations already described, in motion behind it. These plates, as soon as finished, are borne with great delicacy from the place in the edifice, where they were blown and fashioned, to the annealing furnace, capable of containing many hundreds of them, where they are set up side by side, and almost touching each other. The fire is then suffered to expire by degrees; and, after a day or two, the glass having thus acquired its due degree of annealing, is removed, and packed up for exportation. You will take it for granted, that I have omitted some of the minuter operations; but I hope you will not be dissatisfied with your entertainment, when you reflect that I have been obliged to furnish it from no better materials than stone, sand, and salts of ashes!"

On the Carron Iron-Works.

"Instead of keeping the high road all the way from Bannock-Bourn to Falkirk, we quitted it for another on our left, which leads to Carron; our way lying now in that level and pleasant tract of country called the Carse of Stirling, reckoned one of the most fertile and best cultivated regions of Scotland. On approaching Carron, we first descry a small lake, formed by a river of that name, extending along the side of a wood: a long range of dun-coloured brick-buildings, on the farther side of the water, comes next into sight. Beyond these, and above them, we see frequent and palpitating flames, shooting up in the air, and then subsiding amidst vast volumes of black smoke, which fill the atmosphere. As soon as we reached the busy spectacle of the manufactory, a person, properly instructed, conducted us through a series of buildings, distributed around a large enclosure, where our curiosity was amused with a succession of those various processes by which iron is subdued to every form and impression at the will of man.

"For a view of the primary operation, we were led without the precincts which I have mentioned, upon a raised platform, consisting of scoria, cinders, and ashes, and occupying a quarter of an acre of ground. On this were blazing, at different intervals, in the open air, many large coal-fires. Here the iron ore, of which vast heaps from the mines of Lancashire, Cumberland, and Scotland, lay in sight, undergoes the process of roasting. Freed by this preparation from its grosser impurities, it is thrown, together with lime-stone, into furnaces or ovens; several of which are kept continually glowing with the greatest heat, by a discharge of air from an iron tube, as large, at the greatest end, as a twenty-four pounder, and lessening gradually for a length of twenty feet, till the smaller end reaches the bottom of the furnace. Through this and other tubes, a stream of air is communicated to each fire, from four large iron cylinders, or bellows, fixed perpendicularly; the pistons of which, two rising and two descending, in quick succession, cause a continual expiration of air; the strength and violence of the blast filling the edifice with a tremendous roar! These pistons are kept incessantly moving, for the receiving and expressing of the air, by several water-wheels, each twenty-four feet in diameter. The ore being now brought into a state of fusion, an aperture is made in the clay which stops the mouth of the oven, and a cascade of liquid fire instantly rolls forth into a metal receiver or cauldron. The moulds of the different articles to be cast, lie all, ready formed, in figured beds of sand and charcoal. We now see many hands busily employed in lading out the fused metal from the receiver, and hastening with it to the moulds. Here they pour it into certain canals, which distribute it, in due proportion, over the whole surfaces of the moulds. In a few minutes, we are presented with an exhibition of various instruments, utensils, and articles of furniture, subservient to the convenience, comfort, and ornament of social life. Among other pieces of hardware, we saw some Bath stoves, and grate-backs, cast upon very elegant models. But iron work, of every kind, from the candlestick, which holds light to the philosopher in his study, to the cannon, whose thunder announces the power of Great Britain to the remotest inhabitants of the earth, is executed in this magnificent foundery! The forming of iron into pigs, by fusion; and into bars, by the continual beating of ponderous hammers, put into motion by water-wheels, were no unentertaining part of the exhibition. We saw specimens of an infinite variety of articles finished for sale, in our walk through the magazines and repositories belonging to the establishment. The multiplicity and extent of these Vulcanian operations, which are continually carrying on at Carron, may be conceived, from our information, that no less a quantity than two hundred tons of coals are consumed every week upon them!

"To give very particular or distinct ideas of these, or any other manufactures, without plates, is scarcely possible; but from the general images which I have endeavoured to convey, relative to such objects, may be inferred the great power which man has established over the world of matter, by the ministerial agency of fire, air, and water. Of these three elements, science may be said to have formed the grand basis, on which rest all the arts and manufactures, to which our country owes so much of its prosperity and its fame; and in the exercise of which, North Britain has for some time taken so brilliant a share."

LXVII.—*On employing Roundels of Fusible Metal to prevent Explosions in Steam Boilers.* *By M.* GUALTIER DE CLAUBRY*.

THE fatal accident which happened to a steam-boat at Lyons, has caused steam navigation to be held in great disesteem, as well as all high-pressure steam boilers; and notwithstanding the reasons which have been assigned, on the probable causes of the above accident, yet we see that fears are renewed, and, until more certain means of preservation shall have been brought into use, these fears will be productive of great inconvenience.

---

* From De Moleon's *Recueil Industriel.*

The explosion of the boiler of this steam-boat, has been attributed to the imprudence of the engineer or his workmen, who, in order to start the boat, loaded the safety valves, to increase the force of the steam. M. Clement thinks, that perhaps in this boiler, as well as in that which burst several years since, at the manufactory of M. Ferrey, at Essone, and which was also constructed by the same engineer, Mr. Steel, the openings of the steam-valves were of too small a diameter to give passage to all the steam produced. But whatever may have been the causes of the accident, we should endeavour to prevent a repetition of it; and here an important question presents itself, which merits the greatest attention; this consists in finding, amongst the various safety-valves hitherto employed, one which is able to preserve us from all the accidents attending the use of high-pressure steam boilers.

We have seen long since, that the ordinary safety-valves do not always act, owing to various accidental causes, so as to ensure safety; but the curious observation of M. Clement, respecting the valves of the blowing machine at Fourchambalt, and which also perfectly applies to those of steam-engines, has proved, that it is a fact, that with safety-valves of a large diameter, and under a feeble pressure, these valves afford but a false security; and it also equally applies, when their levers are loaded by an augmentation of weight. We must therefore recur to other means, in order to avoid those accidents which arise from the too strong pressure of the steam.

The roundels of fusible alloys, which melt at the temperature caused by the pressure to which we would raise the steam, have, for several years, obtained the approbation of the most enlightened men; and positive experiments have proved that their use would be most advantageous.

Nevertheless, a man of science, whose name is of authority, and to whose opinions we should with pleasure defer, has adopted an opinion of a contrary nature; and which would exercise an unhappy influence, were we to suffer it to pass without examination; and therefore it seems proper to provoke a discussion on this important subject, one of the most useful kind, and which may produce results that certainly will benefit science.

These roundels of alloys are composed of various proportions of the three metals, bismuth, lead, and tin, and which, according to their relative quantities, melt at particular temperatures; and thus, by a fusion more or less complete, open a free passage to the steam, and hinder the fracture of the boiler, which might otherwise experience too strong a pressure; but the greatest care ought to be taken to insure that these roundels should produce their intended effects. They should therefore be composed in such proportions, that they should melt at a temperature but little higher than that at which the steam-boiler of the machine ordinarily works.

They should also be placed in a situation well chosen, as it is known that in various points of the surface of the boiler, the pressure is not perfectly equal, and that a roundel which would melt at one point, will remain solid in another; and thus it is not sufficient to provide roundels which should melt under the pressure and temperature of two, three, or four atmospheres, &c., unless we have also well determined the point at which this pressure and temperature exist. For instance, if the safety-valve be placed over the fire-place, or at the extremity of the boiler, it is not likely, that under similar circumstances, the roundel should always melt at the convenient time; so also if it be placed in a pipe more or less elevated. It seems that the best position for the roundel would be over the fire-place*.

---

* It was in this position, that Mr. Trevitheck placed his safety-plugs, in the bottoms of his high-pressure steam-boilers.—EDITOR.

This observation agrees with the opinion of M. Clement, who says, in his course of lectures on the applications of chemistry to the arts, that in pursuing the theoretic idea of adopting the use of the fusible roundels, we must not only calculate upon their fusion, but also upon their softening; and he exhibited one to his auditors, in which its change of form was visible, and this before it had become soft.

In order to judge of the defect in this roundel, it would be necessary to know, in the first place, whether it had been placed in the most convenient situation; and, secondly, whether it was composed of good proportions; two circumstances which might exert a remarkable influence upon its change of figure. When a fusible roundel is struck by the steam, at a temperature nearly approaching to that of its fusion, and as the alloys, according to the proportions of which they are composed, soften at different temperatures; so small parts of them experience a liquation, which we see appear in the middle of the surface of the roundel, in the form of globules, of which the number continually augments, so as at length to form a swelling, resembling the head of a cauliflower; in the midst of which an opening is produced, which affords an issue to the steam: but if the temperature be raised gradually, the liquation will continue, and bulge out the metal, especially in the centre, where the fusion has taken place, but not towards the edges, and thus form a projecting disk.

(To be continued.)

LXVIII.—*On Refining Gold and Silver, and making Sulphate of Copper, at Paris. By M.* D'ARCET.

(Continued from page 289.)

On Ventilating the Refineries.

This has been effected in two different ways, in a refinery established in the year 1826, upon a large scale, and where the situation of the premises allowed every advantage to be taken, five furnaces, for heating as many platina boilers, were constructed adjoining to each other, and placed under an arch, from whence openings proceeded through a back wall, into a common channel, which conveyed the heated air from the furnaces downwards, into a subterranean horizontal flue, opening into a tall chimney or stack, erected in the centre of the refinery; and which stack was surrounded with three wind-furnaces, and two furnaces of evaporating boilers, erected in the vault underneath the laboratory of the refinery; and which wind-furnaces had fires made in them previously to those of the platina boilers, in order to produce an ascending draught in the stack or main chimney. The front of the arch, under which the five furnaces of the platina boilers were erected, was generally kept closed, by means of hanging doors or plates let down whilst the process of solution was carrying on. The acid fumes from the platina boilers were conducted away through horizontal leaden tubes, and which were united with vertical ones, leading into a vessel or chest lined with lead, placed in the vault below, and where the fumes were partly condensed; the uncondensible fumes being then passed into two other leaden chests, and, finally, through a cylindrical vessel, mounted upon hollow axes, and containing hydrate of lime, which, on the vessel being continually turned round by hand, formed a shower of lime, and thus arrested the greater part of the sulphurous acid vapours, the small remaining portion being conveyed away into the main chimney or stack. As, however, this disposition of the furnaces was not applicable to the case where the refinery was already erected, and the furnaces placed in a line, and on the ground floor only; so M. D'Arcet contrived another disposition of them, and which was carried into execution in the year 1828. Here the furnaces of eight platina boilers were erected side by side in one line, the heated air from the furnaces being conveyed by flues from each, passing into a horizontal main flue, which, in the middle of it, communicated with a tall chimney or stack. The acid vapours from the platina boilers, were, in this case, led into a long common leaden tube or channel, laid a little declining from the horizontal position; and at its lower part, a contraction of its diameter took place, and what acid vapours had condensed in it, were there led down a vertical leaden pipe, into a vessel lined with lead, placed to receive them. The condensed acid vapours were then passed into two large leaden chambers, with water at their bottoms, similar to those of the sulphuric acid works, and, finally, through a turning cylinder, and exposed to a shower of hydrate of lime, as in the former case; and the uncondensible gaseous part conducted through an ascending pipe, into the stack or chimney, and which was furnished at top with a moveable hood or turn-cap.

It is indeed greatly to be regretted, that the high price of malleable platina renders it nearly impossible to employ these judicious arrangements and processes in this country, in the refining of gold and silver.

LXIX.—*On Preserving Birds for Cabinets of Natural History. By* CHARLES WATERTON, *Esq.*[*]

WERE you to pay as much attention to birds as the sculptor does to the human frame, you would immediately see, on entering a museum, that the specimens are not well done.

This remark will not be thought severe, when you reflect that that which was once a bird, has probably been stretched, stuffed, stiffened, and wired by the hand of an ignorant person. Consider, likewise, how the plumage must have been disordered, by too much stretching or drying; and perhaps sullied, or at least deranged, by the pressure of a clumsy and heavy hand,—plumage which, ere life had fled from within it, was accustomed to be touched by nothing rougher than the dew of heaven, and the pure and gentle breath of air.

---

[*] From his "Wanderings in South America."

In dissecting, three things are necessary to insure success, viz. a penknife, a hand not coarse or clumsy, and practice. The first will furnish you with the means, the second will enable you to dissect, and the third will cause you to dissect well. These may be called the mere mechanical requisites.

In stuffing, you require cotton, a needle and thread, a small stick, the size of a knitting-needle, glass-eyes, a solution of corrosive sublimate, and any kind of a common temporary box, to support the specimen whilst stuffing it. These also may pass under the same denomination as the former; but if you wish to excel in the art—if you wish to be in ornithology what Michael Angelo was in sculpture, you must apply profound study, and your own genius, to assist you. And these may be called the scientific requisites.

You must have a complete knowledge of ornithological anatomy. You must pay close attention to the form and attitude of the bird, and know exactly the proportion each curve, or extension, or contraction, or expansion, of any particular part bears to the rest of the body. In a word, you must possess Promothean boldness, and add life, fire, and animation, as it were, to your preserved specimen.

Repair to the haunts of birds, whether on plains or mountains, in forests, swamps, or lakes; and devote your time to examine the economy of the different orders of birds.

Thus, you will place your eagle in a commanding attitude. Your pie will seem crafty, and just ready to take flight, as though fearful of being surprised in some mischievous act of plunder. Your sparrow will retain its wonted pertness, by means of placing its tail a little elevated, and giving a moderate arch to its neck. Your vulture will show his sluggish habits, by keeping his body nearly parallel to the earth; his wings somewhat drooping, and their extremities under the tail, instead of above it,—expressive of ignoble indolence.

You will observe how beautifully the feathers of a bird are arranged, the one falling over the other, in the nicest order; and that where this fine harmony is interrupted, the defect, though not noticed by an ordinary spectator, will immediately appear to the eye of a naturalist. Thus a bird not wounded, and in perfect feather, must be procured if possible; for the loss of feathers can seldom be made good; and where the deficiency is great, all the skill of the artist will avail him little in his attempt to conceal the defect; because, in order to hide it, he must contract the skin, bring down the upper feathers, and push in the lower ones, which will throw all the surrounding parts into contortion.

You will also observe, that the whole of the skin does not produce feathers, and that it is very tender where the feathers do not grow. The bare parts are admirably formed for expansion about the throat and stomach; and they fit into the different cavities of the body at the wings, shoulders, rump, and thighs, with wonderful exactness; so that in stuffing the bird, if you make an even rotund surface of the skin, where these cavities existed, in lieu of reforming them, all symmetry, order, and proportion, will be lost.

You must lay it down as an absolute rule, that the bird is to be entirely skinned, otherwise you can never succeed in forming a true and pleasing specimen. You will allow this to be true after reflecting for a moment on the nature of the fleshy parts and tendons, which are but too often left in; for, first, they would require to be well seasoned with aromatic spices; secondly, they would require to be put into an oven to dry; thirdly, the heat of the oven, and the tendency which all cured flesh has to shrink, and become hard, would render the specimen withered, distorted, and too small; and, fourthly, the inside would become like a ham, or any other dried meat, and, ere long, insects would claim it for their own; the feathers would then begin to drop off, and you would have the hideous spectacle of death, clad in ragged plumage!

Wire is of no manner of use; but, on the contrary, is a great nuisance. For, where it is introduced, a disagreeable stiffness, and a derangement of the symmetry, must inevitably follow.

The head and neck can be placed in any attitude; the body can be supported; the wings closed, extended, or elevated; the tail depressed, raised, or expanded; the thighs set horizontally or obliquely; and all without any aid from wire:—cotton alone will effect all this.

A very small portion of the bone of the skull, say from the fore part of the eyes to the bill, may be left in, though even this is not absolutely necessary. Part of the wing-bones, the jaw-bones, and half of the thigh-bones, must also remain; but every thing else, as the flesh, the fat, the eyes, bones, brains, and tendons, are all to be removed.

While dissecting, it will be of use to keep in mind, that in taking off the skin, by means of the finger and a small knife, you must endeavour to push instead of pulling it off, least you stretch it.

That you must press as lightly as possible on the bird; and every now and then take a survey of it, in order to see that the feathers, &c. are all right.

That when you come to the head, you must take care that the body part of the skin rests on your knee; for if you allow it to dangle from your hand, its own weight will stretch it too much.

That throughout the whole of the operation, as fast as you detach the skin from the body of the bird, you must push cotton immediately between the skin and the body; and this will effectually prevent any fat, blood, or moisture from coming into contact with the plumage. Here it may be observed, that on the belly you will find an inner skin, which keeps the bowels in their place. But, by a nice operation with the knife, you can cut through the outer skin, and leave the inner skin whole. Attention to this will render your work very clean; so that, with a little care in other parts, you may skin a bird without even soiling your finger-ends.

As you can seldom procure a bird but by shooting it, so a word or two on this head will be necessary. If the bird be still alive, press it hard with your finger and thumb just behind the wings, and it will soon expire; then carry it by the legs, and the body being reversed, the blood cannot escape down the plumage from the shot-holes. But as the blood will often have issued out before you may have laid hold of the bird, so you may find out the shot-holes by dividing the feathers with your fingers, and blowing upon them; and then, either with your pen-knife, or the leaf of a tree, you must carefully remove the clotted blood, and put a little cotton upon the holes. But if, after all, the plumage have not escaped the marks of blood, or if it may have imbibed any slime from the ground, then wash the parts in water, without any soap, and keep gently agitating the feathers with your fingers, till they are quite dry. But were you to wash them, and then leave them to dry by themselves, they would have a very mean and shrivelled appearance.

In the act of skinning a bird, you must either place it upon a table, or upon your knee; but probably you will prefer your knee; because, when you cross one knee over the other, and have the bird placed upon the uppermost one, you can either raise it up to your eye, or lower it, at pleasure.

With these precautionary hints kept in mind, we will now proceed to dissect a bird.—Suppose it be a hawk for instance. We place close by us a small bottle containing a saturated solution of corrosive sublimate, made in proof spirit; a slender stick, like a common knitting-needle; and a handful or two of raw cotton. You then first fill the mouth and nostrils of the bird with cotton, and then place it upon your knee, on its back, with its head pointing towards your left shoulder: you then take hold of the pen-knife with your two first fingers and thumb, the edge of it being upwards; you must not, however, keep the knife perpendicular to the body of the bird, because, were you to hold it so, you would cut the inner skin of the belly, and thus let out the bowels. In order to avoid this, let the knife be kept parallel to the body, and then you will divide the outer skin only, with great ease.

Begin on the belly, below the breast-bone, and cut down the middle quite to the vent; this done, put the bird into any convenient position, and separate the skin from the body, till you arrive at the middle joint of the thigh; cut this through, and do nothing more there at present, except the introducing cotton underneath the skin, as above-mentioned, all the way on that side, from the vent to the breast-bone; do exactly the same on the opposite side.

Now place the bird perpendicularly, its head resting on your knee, and with its back towards you; then separate the skin from the body on each side, at the vent; but never mind, at present, the part from the vent to the root of the tail; then bend the tail gently down to the back, and, while your finger and thumb are employed in keeping down the detached parts of the skin, on each side of the vent; cut quite across and deep, until you see the back bone, near the oil-gland, at the root of the tail; then sever the back-bone at the joint, and you have all the rest of the tail, together with the oil-gland, dissected from the body. Apply plenty of cotton.

After this, seize the end of the back-bone between your finger and thumb; and now you can hold up the bird clear of your knee, and turn it round and round, as occasion requires. While you are holding it thus, contrive, with the help of your other hand, and the knife, by cutting and pushing, to get the skin thrust up, till you come to where the wing joins to the body.

Note, forget not to apply cotton; cut this joint through; do the same to the other wing, add cotton, and gently push the skin over the head; cut out the roots of the ears, which lie very deep in the head; and continue skinning, till you reach the middle of the eyes; and after this, nothing difficult intervenes to prevent your arriving at the root of the bill.

When this is effected, cut away the body, leaving a bit of the skull, however, just as much as will reach to the fore parts of the eyes; and clean the jaw-bones well; then fasten a little cotton to the end of your stick, dip it into the solution of corrosive sublimate, and touch the skull, and the corresponding part of the skin, with it, as you cannot well get at those places afterwards. From the time of pushing the skin over the head, you are supposed to have had the bird resting upon your knees; keep it there still, and, with great caution and tenderness, return the head through the inverted skin; and when you see the beak appearing, pull it very gently till the head comes out unruffled and unstained.

You may now take the cotton out of the mouth, and cut away the flesh remaining at the palate; and likewise whatever may have remained at the under-jaw. There is now before you the skin, without the loss of any of its feathers; and all the flesh, fat, and unclean bones, separated from it, excepting the middle joints of the wings, one bone of each thigh, and the fleshy root of the tail. The extreme points of the wings are very small, and, comparatively speaking, have no flesh upon them; so that they require no attention, except touching them with the solution from their outsides. Then, take off all the flesh from the remaining joints of the wings, and tie a thread, of about four inches long, to the end of each; touch all with the solution, and push the wing-bones back into their places. In baring these bones, you must by no means pull the skin, or you would tear it to pieces beyond all doubt, for the ends of the long feathers are attached to the bones themselves; you must therefore push off the skin with your thumb-nail and fore-finger. Now skin the thighs, quite to the knees; cut away all the flesh and tendons, and leave the bones; next, form artificial thighs around them with cotton; then apply the solution, and drew back the skin again over the artificial thighs.

Lastly, proceed to the tail; take out the inside of the oil-gland, and remove all the remaining flesh from the root of the tail, until you see the ends of the tail-feathers; then apply the solution, and replace the skin. Now you may take out all the cotton, which you have been putting into the body from time to time, in order to preserve the feathers from grease and stains. Then place the skin of the bird upon your knee, on its back; tie together the two threads which you had fastened to the ends of the wing-joints, leaving exactly the same space between them as your knowledge in anatomy informs you existed there when the bird was entire. Hold the skin open with your finger and thumb, and apply the solution to every part of the inside; you may, however, neglect the head and neck at present, as they are to receive it afterwards.

Then fill the body moderately with cotton, lest the feathers should be injured, whilst you are performing the following operation. You will recollect, that half the thighs, or, in other words, one joint of each thigh-bone, have been cut away. Now, these bones never moved perpendicularly to the body; but, on the contrary, in an oblique direction. But, of course, as soon as they were cut off, the remaining parts of the legs and thighs, having now nothing to support them obliquely, must naturally fall perpendicularly; and hence the reason why the legs of stuffed birds appear considerably too long. Now, in order to correct this defect, take your needle and thread, fasten the end of the thread round one of the bones, inside, and then push the needle through the skin just opposite to it; then look on the outside of the skin, and after finding the needle amongst the feathers, tack up the thigh under the wing with several firm stitches; the repetition of this operation will thus shorten the thighs, and also render them quite capable of supporting the weight of the body without the help of wires. This done, now take out all the cotton, except that forming the artificial thighs, and adjust the wing-bones (which are connected by the threads) in the most even manner possible, so that one joint does not appear to lie lower than the other; for, unless they are quite equal, the wings themselves will be unequal, when you are about to put them into their proper attitudes.

Here then rests the skin of the hawk, ready to receive from your skill and judgment, the size, the shape, the features, and expression it had, ere death, and your dissecting hand, brought it to its present still and formless state. When the heart ceases to beat, and the blood no longer courses through the veins, the features collapse, and the whole frame seems to shrink within itself. If, then, you have formed your idea of the real appearance of the bird from a dead specimen, you will be in error. With this in mind, and at the same time forming your specimen a trifle larger than the life, to make up for what it will lose in drying, you will produce a bird that will please you.

(*To be continued.*)

LXX.—*On Freeing the inferior kinds of Brazil Wood, and Logwood, from their Yellow Colouring Matter. By* Dr. Dingler*.

There are many inferior species of Brazil wood, known by the names of wood of Bines, of St. Martha, of Ancola, of Nicarague, of Sapan, &c. which are much poorer in red colour, than the genuine wood of Fernambouc; and which, besides, contain a considerable quantity of yellow, or fawn colour, which deadens the lustre of the red, and renders it almost impracticable to employ them with advantage in dyeing or printing. The genuine Fernambouc wood having become very scarce (in Germany), and its price exhorbitant, it will be interesting to the manufacturers to learn a method of supplying its place by the inferior sorts of wood.

The process is the following:—Cut or rasp the wood in the usual way, and extract, by boiling in water, all the colouring matter which it contains ; evaporate the liquor very considerably, so as, for example, to get all the colour produced from four kilogrammes of the wood, in twelve or fifteen kilogrammes of liquid ; then, when it is cold, add to it, twelve hours afterwards, two kilogrammes of skimmed milk. Stir the mixture, and boil it for a few minutes, and then strain it through a thick flamnel. The liquid will soon become turbid, and all the yellow colour will unite with the milk, and fall to the bottom; whilst all the red dye will remain in the supernatant fluid. If this be wanted for piece-dyeing, it must be diluted with water before using; but if it is to be employed for block-printing, it should be evaporated to about half its quantity, and then thickened with starch or gum. If to this be added some solution of tin, or some other mordant, to heighten the tint, the artist will have a red, equal, if not superior, to that from the best Fernambouc, both in lustre and durability.

---

* From the *Journal Polytechnique*, of Ausbourg, and the *Annales de Chimie*.

The quantity of skimmed milk to be used, should always bear a due proportion to that of the colour presumed to exist in the wood. If it is young, and consequently, poor in dye, two kilogrammes of milk are sufficient for six or eight kilogrammes of the wood; and the evaporation for block-printing, must of course be governed by this principle. In making lakes, the manufacturer will easily discover, by the different tints which he meets with, the quantity of inferior wood required to supercede the true Fernambouc.

These decoctions may be used immediately after they are made, nothing is gained by keeping them.

LXXI.—*On the Artificial Specular Iron Ore, for Improving Razor-Strops. By* M. MERIMEE*.

ONE way to have good razors, is to learn how to sharpen them well; and to do this, is much less difficult than to learn to shave. If a little skill is necessary to strop a razor properly, a good strop is indispensable. The various forms in which strops have been made, and the many new and boasted compositions for preparing them, prove, at least, the importance attached to this operation. It is with a view to render it more easy and certain, that I have determined to make known a preparation, which has appeared to me, as well as to all those who have used it, particularly adapted to make the edges of razors extremely sharp. I prefer the flat form for the strop, because I find it more convenient for keeping the edge of the razor in the same plane. The quality of the leather, of which it is made, is of great importance. It should be fine grained, of a close texture, giving way equally under the pressure of the blade. As skins of this quality, sufficiently thick, are rarely met with, two pieces may be carefully glued together. To graduate the action of the substances employed to sharpen the razors, the razor-strop must have two faces. The powders to be applied on the first face, may be any of the substances which have an action on tempered steel, such as emery, hone or whet-stone powder, slate or pumice-stone powder, calcined clay, iron cinders, or scales, &c. The hardest should be preferred, because they will wear the longer. These should be well ground, and sifted through silk. Whatever mixture of powders be adopted, it is necessary to add to it some powdered *charcoal*, which has the effect of preventing the composition from adhering to the razor; and, if added in proper proportion, the razor will slide over it, without carrying away the slightest part*.

---

* Abridged from the *Bulletin de la Société d'Encouragement.*

These powders are commonly mixed with grease, into a kind of pomatum, which is applied uniformly upon the leather. It is better to lay on a very slight coat of grease, to spread the powder on afterwards, and make it adhere every where equally, by rubbing it with the finger. Thus any particles large enough to endanger the edge will be felt; and, by continuing to rub, may be removed from the surface of the leather.

---

* A renovator for razor-strops has long been sold in London, which the Editor discovered, by the aid of his microscope, was composed of the red oxide of iron, mixed with ground glass; and which has the effect of causing the razor to slide over it, in the manner above described. The Editor, in consequence of his discovery, formed a composition possessed of exactly the same properties.—Editor of The Technological Repository.

Grease should be preferred to oil, by reason that it does not dry; and that drying-oil might sometimes be used in mistake, which would soon harden the leather, and render it useless.

To finish the edge of the razor, the powders hitherto employed are colcothar, the finest washed emery, black-lead, &c. I have tried all of these substances, and have found that they produce less effect than a crystallized tritoxide of iron, called by the French mineralogists, *fer oligiste speculaire*. What is found in nature may be used, or the artificial may be prepared, in the following manner:—Take equal parts of sulphate of iron *(green vitriol)*, and hydrochlorate of soda (kitchen salt); rub them together in a mortar; fill a crucible with the mixture, and heat it red-hot. A considerable quantity of the vapour will be disengaged, and the matter will resemble metal in fusion. When vapours will no longer arise, remove the crucible from the fire, and let it cool. It will then contain a saline substance, of a violet-brown colour, covered with extremely brilliant spangles, and perfectly like specular iron.

Dissolve the mass in water, and wash it, to carry off the salts, and to separate a more or less considerable portion of uncrystallized oxide, which, by its greater lightness, will remain suspended in the water, while the micaceous spangles fall to the bottom. These spangles only are to be kept for sharpening razors. The other portion will make excellent red polishing powder.

To prepare a large quantity, a small cupel will be preferable to a crucible, as presenting a larger surface to the air. The fire must not be too violent, nor too long continued; for then the powder would be black, extremely hard, and would produce no good effect. It is so much the better, as it more approximates to the colour of the violet *aventurine*.

This powder should not be mixed with any grease. However if the strop is new and dry, the leather should be slightly rubbed with tallow, and then wiped. It will then always be greasy enough to hold the powder. The razor ought to slide over it, without sticking to the leather. When it begins to stick, fresh powder must be applied. The razor should be wiped before it is stropped on the last side of the razor-strop, to finish the edge*.

LXXII.—*On the Draught in Chimnies. By* MARCUS BULL, *Esq.*†

SIR,

I SUBMIT for insertion in your Journal, the subjoined replies to the queries of a citizen of New Jersey, which appeared in the number for March last.

Your's, &c.

MARCUS BULL.

To Dr. THOMAS P. JONES,
Editor of the Journal of the Franklin Institute.

Query 1st. Upon what principle does the draught of an air-furnace depend?

The draught, or, more properly, the current of air through a chimney, is procured in consequence of air possessing the property of expansion, when subjected to heat, by which expansion its specific gravity is decreased. The column of air within the chimney, when heated, dilates, and thereby becoming lighter than the surrounding air, it is forced to ascend the chimney, by the surrounding pressure of the column of cold air, and thus the current is established.

---

* Instead of a strop, I have seen a plane metallic plate, an alloy of tin, oiled, employed with great success, in settting razors and surgeon's instruments. Leather was objected to, on account of its rounding the edge.—Translator of this Article, for Dr. Thomas P. Jones's "*Journal of the Franklin Institute.*"

† From the *Journal of the Franklin Institute.*

2nd. What effect will an increased height of the chimney have on the draught?

In some cases an injurious, and in others a beneficial, effect. The proper height of a chimney to produce the most powerful combustion in the furnace, is governed by particular circumstances. If the furnace, or receptacle for the coals, be of large dimensions, and capable of producing great heat, and the chimney be constructed of materials which are bad conductors of heat, its height may, with advantage, be greater, than should be the case if the furnace be small, and the chimney composed of materials which are good conductors of heat.

Chimnies are intended to enclose and convey away the gaseous products of combustion, smoke, &c., and to prevent their dispersion, so long as they retain sufficient heat to render them more rare than a column of the external air equal to the contents of the chimney; hence the propriety of constructing them of materials which are bad conductors of heat.

The quantity of air passing through a well constructed furnace in a given time, will be proportional to the difference in temperature, or specific gravity, between the columns of air within and without the chimney, and to their height. In theory, we should suppose, all other things being equal, that the height of a chimney should be such, that the ascending current would leave it at the temperature which would allow its specific gravity to be precisely that of the external air, as this would give the longest rarified column; but as the temperature of the air, both within and without the chimney varies almost constantly, experience suggests the propriety of constructing chimnies of such height only as will permit the smoke, &c. to pass off whilst considerably rarified, under all states of the weather; but no experiments have been made to determine the precise difference in temperature at which the ascending column should be permitted to escape; and this, indeed, must vary with every difference in the nature of these products of combustion, dependant upon the more or less perfect decomposition of the air in passing through the furnace.

3rd. If an increased height of the chimney increases the draught, what is the ratio?

All other things being equal, the ratio of increase will depend on the materials and area of the chimney; but, in all cases, this latter must diminish as we increase its height; the first foot producing more effect than the second, and the fifth more than the tenth, &c.

If the chimney be composed of materials which are bad conductors of heat, the included column will cool at a slower rate than if the materials made use of be good conductors of heat; consequently, the ratio of increase must vary through any given space. In like manner, the cooling of a large and a small column will be at different rates.

From the results of Mr. Dalton's experiments to determine the expansion of air by heat, it appears that from thirty-two to two hundred and twelve degrees of Fahrenheit, every forty-five degrees of temperature produces an expansion of about one-tenth, which will reduce the absolute weight of any given volume so expanded one-twentieth; but as the products of combustion possess greater specific gravity than an equal volume of the external air, at the same temperature, and as these vary, so we cannot estimate the precise difference in the pressure of the two columns, merely from their difference in temperature.

4th. What effect will an increase or diminution of the superficial area of the chimney have on the draught?

If the passage for the aeriform products be too small to allow them to escape freely, the quantity of air which would otherwise pass through the furnace in a given time, is diminished, and the combustion is consequently retarded.

If, on the other hand, the passage is larger than is necessary for their free escape, the sides of the chimney will also present a larger refrigerating surface, which reduces the temperature of the included air more rapidly, and consequently increases its specific gravity, by which the velocity of the current is impeded.

To produce the most intense combustion, it is necessary that the furnace be perfectly supplied with air; and when that portion of it which may remain undecomposed, together with the products of combustion, shall have passed through the furnace, what is ordinarily called the draught must be such as to force them to escape through the chimney with the greatest velocity; as that furnace which will consume the greatest quantity of air and coals in a given time, must necessarily produce the greatest amount of heat. But no satisfactory experiments have as yet been made, to ascertain the proportions which should exist between the various parts; hence data are wanting to proceed upon principle, and we can only accomplish the end in view by repeated trials.

5th. Will a chimney, largest at its top, or *vice-versa*, make the strongest draught?

As that portion of the column of heated air, &c., nearest the burning coals must necessarily be the most expanded, and require more room than at the top of the chimney, where their temperature and volume are diminished; so a chimney largest at the bottom, must be better calculated to promote a rapid current through it, than the same chimney with its apex reversed.

6th. Is it important, as regards the draught, that the materials of which a chimney is composed be good conductors of heat, or otherwise?

It is very important that the materials be bad conductors of heat, that the included column of air, &c. may be cooled by the slowest progress. The advantage of this has already been stated in the answers to some of the preceding questions.

7th. What is the best mode of binding the chimney of an air-furnace, to prevent its cracking?

This is a question so entirely practical, that the answer must be given by one who has had much experience on the subject ; the writer of the foregoing replies will not therefore attempt it ; but hopes that some liberal iron-master, or founder, will afford the required information ; which, whilst it may give strength to his neighbour's chimnies, will not have the effect of weakening his own.

LXXIII.—*On the Union of Mechanical Skill with the Highest Attainments in Science. By Dr.* THOMAS P. JONES*.

WITHOUT attempting to exhibit a scale of the relative excellence of associations formed under the united influence of patriotism and benevolence, we may claim for our own a high station, and need not fear that our claims will be disputed. In its purview it embraces one of the largest classes of men in every civilized community ; a class upon whose operations is founded almost every thing which distinguishes a state of culture from barbarism, the philosopher from the savage.

To recount the operations of the mechanic, and to exhibit them as they contribute to the blessings of existence, would require the life of an antediluvian ; excepting the products of nature in their unaltered state, every object upon which we can turn our eyes in the habitations of man, would present a subject for dissertation ; a nail, or a pin, would furnish us with materials for a history ; a history, in which its origin and progress would, in general, like that of nations, be found to defy the researches of the most industrious.

It has been imagined by some philosophers, that the first efforts of man in the arts were imitative, having been suggested by those of the brute creation. "It may be true," says Lord Monboddo, "that man first learned to build from the swallow, from the spider to weave, and from the birds to sing :" his lordship, however, was remarkable for a creative fancy, as is evinced by his imagining, in one of his philosophical dreams, that, in the ourang-outang, we might discover our own progenitors. Mr. Pope, in his "Essay on Man," has presented us with a similar idea respecting the origin of the arts, where he says,

---

* From the *Journal of the Franklin Institute.* This Article formed the substance of a Lecture, introductory to a course of Mechanics, delivered to the Franklin Institute, of the state of Pennsylvania, by Dr. Jones, January 24th, 1826.

> "Go, from the creatures thy instruction take;
> Learn from the birds what food the thickets yield;
> Learn from the beasts the physic of the field;
> Thy arts of building from the bee receive;
> Learn of the mole to plough; the worm, to weave;
> Learn of the little nautilus to sail,
> Spread the thin oar, and catch the driving gale."

The philosophy of the poet, and the poetry of the philosopher, are assuredly contradicted by observation and experience; these seem plainly to indicate, that the common adage, which says, that "necessity is the mother of invention," is a truism which is felt and exemplified in the experience of every man, and in almost every hour of his life. In the earliest stages of society, the inclemency of the weather must have suggested the necessity of a shelter; the vicissitudes of the seasons, the use of some kind of covering for the body; and the employments of the chase, the formation of instruments for attack and defence.

Many of the arts undoubtedly originated in accident; the smelting of ores, the formation of glass, and the manufacture of pottery, were, probably, of the number. Whenever man had acquired a knowledge of the use of fire, its effects upon certain kinds of clay, exposed to its action, must soon have attracted notice; and an article so easily moulded into any form, could scarcely fail of being brought into use. The making of earthenware probably preceded the discovery of the metals, as it could be formed without their aid.

The art of working some of the metals, appears to have preceded the deluge; we could not, indeed, imagine such a vessel as the ark to have been built without their use. The metals first known, were probably found native; in which state they frequently exist on or near the surface of the ground, beneath which beds of ore are deposited. The accidental employment of fire in contact with some of their ores, was very likely to suggest the method of reducing them to the metallic state. In conformity with this idea, it has been asserted, that iron was discovered at an early period of Grecian history, by the burning of the forests of Mount Ida; and the knowledge of the silver mines of the Pyrennees, is attributed to a similar cause.

According to Pliny, the formation of glass, by the union of sand with the mineral alkali, was an accidental discovery. It is said, that a vessel, loaded with the latter article, was cast on shore, and that the fires made by the mariners on the sand, caused the fusion of the alkali and the earth, and thus produced glass; the hint thus given was pursued, and the useful and beautiful material became an article of manufacture.

It is not my intention, in the present lecture, to pursue the inquiry into the origin of the useful arts, but to give to my observations a more certain and practical direction, by noticing their application in the highest attainments of science. It is to the skill of the artisan that we are indebted for those accurate observations which have made us so intimately acquainted with the mechanism of the heavens; and which have enabled us practically to solve that long propounded problem, the discovery of the longitude at sea. This history of the progress of astronomy, and of the improvements in navigation, would, also, be a history of the progress of mechanical skill; and, indeed, our most distinguished mechanics have become so, in consequence of their acquaintance with scientific principles; and our most distinguished philosophers have been, also, remarkable for their mechanical genius. A few examples will prove the correctness of these observations.

It was not until the year 1725, that any instrument was possessed by the astronomer, which was worthy of any particular notice, on account of its accuracy; at this period, a mural quadrant was made by Graham, a celebrated and scientific clock and watch-maker, in London; this instrument, made for the Royal Observatory, was unique in its kind, and still exists, a monument of the skill of the artist, who not only availed himself of the contrivances of his predecessors, but manifested his extraordinary genius, by inventing new methods for giving to his work that permanence and accuracy upon which its value depended.

In a few years after this, a self-taught artist, of the name of Bird, became an able competitor of Graham. Bird was bred a weaver, and was led to turn his attention to the division of circles, by observing a common clock, upon the face of which the minutes were not accurately divided. Pursuing a happy train of thought on this subject, he was soon convinced that he had detected the causes of the errors in the methods which had been followed, and had discovered the means of correcting them; and although he went to London unknowing and unknown, he was, in the course of a few years, reputably established as a mathematical instrument maker. These two artists, Graham and Bird, continued, for many years, not only to supply instruments for their own country, but the philosophers of France, and the governments of many other countries, acknowledged their superiority, by obtaining them for their surveys and observatories. Some idea of the excellence of their instruments, may be formed from the fact, that by them the error in the going of a clock was ascertained to the fifth part of a second; nine observations out of twelve not differing more than one-tenth of a second from the mean result. So largely is astronomy indebted to these instruments, and to others since made, with many improvements, by Ramsden and Troughton, that it is acknowledged that the single observatory at Greenwich, has done more for the improvement of astronomy, than all the other observatories of Europe taken together. Baron de Zach, speaking upon this subject, observes, " If any one should assert, that our astronomical tables would be equally perfect if the other hundred and thirty European observatories had never existed, he would be very well able to support his assertion."

Whilst the mechanic has thus given value to the observations of the astronomer, enabling him, by his accurate divisions of space, to ascertain the positions of the heavenly bodies within the one-three thousandth six hundredth part of a degree; navigation has derived equal advantages from the perfection with which chronometers, or instruments for marking the divisions of time, have also been made. We cannot now trace their history, but will cite an example of their surprising accuracy. Four time-keepers of this kind, made by Parkinson and Frodsam, of London, were taken, by Captain Parry, to the polar regions, where they were exposed to a degree of cold eighty-seven degrees below the freezing point; upon his return, after an absence of eighteen months, the greatest error was only seven seconds in time; and the mean error of the whole four, under two seconds; these, therefore, must have enabled them to discover their longitude within a few hundred yards, leaving nothing farther to be desired in this particular.

Newton, whose name is associated in our minds with every thing that is great and excellent in science generally, but particularly in astronomy, delighted, in early life, in mechanical pursuits. "It is recorded of him, that while at school, his thoughts ran more on practical mechanics, than on his regular exercises; and that during those hours of recreation, which the other boys devoted to play, he was busy with hammers, saws, and hatchets, constructing miniature models and machines of wood. Among his first efforts was a wooden clock, kept in motion by water, and telling the hours on a dial-plate at the top. He made kites, to which were attached paper lanterns, and one of his favourite amusements was flying them in the night, to the consternation of the neighbouring inhabitants. He fabricated tables, and other articles of furniture, for his schoolfellows, and is said to have invented and executed a vehicle with four wheels, on which he could transport himself from one place to another, by turning a windlass."

After he had completed his collegiate studies, he was ardently engaged in his experiments on light and colours, and had commenced his observations on the heavenly bodies. He employed himself on various attempts to improve the telescope, and ground a great number of lenses, inventing a variety of methods for giving to them the forms which he desired, and by which he expected to remove the imperfections of that instrument; when foiled in this attempt, he had recourse to the principle of reflection, and with his own hand manufactured two reflecting telescopes, the first of which is still in the possession of the Royal Society. To polish the metallic mirror, is even at the present day an operation successfully performed by very few mechanics; yet this Newton accomplished in the most perfect manner, and the method which he invented of giving the highest polish, without injury to the perfection of the surface, by finishing it on a tool covered with pitch, was one of those happy thoughts which are born of superior genius alone. This method is still followed, nor is it likely that another, equally good, will ever be devised.

James Ferguson, who, from a very humble station in life, became, by his genius and industry, a practical philosopher of distinguished reputation, first attracted attention, when only seven or eight years of age, by constructing machines to illustrate the properties of some of the mechanical powers, of which he imagined himself to be the inventor; he made a wooden clock, which is said to have kept tolerable time. Having seen the description of a globe in a book borrowed from a neighbour, he constructed one of sufficient accuracy to enable him to work all the ordinary problems. He attempted to make a watch, with wheels of wood, and a whalebone spring, having no other intimation of its structure than that obtained from a gentleman, who was passing along the road, near the house of his father;

and who, observing his anxious curiosity, showed him the inside of his watch, and explained to him the principle upon which the spring gave it motion. Notwithstanding the materials of which young Ferguson's watch was constructed, were too rude to allow it to go, yet it served to prove his extraordinary patience and skill. Although, indeed, he is not entitled to rank as a first rate genius, yet he became a distinguished lecturer on astronomy and natural philosophy, and was for some time the instructor of George the Third on these subjects. He published many works, which are still esteemed for a peculiarly familiar and perspicuous style, derived, in a great degree, from his skill in mechanics, which he happily applied to the illustration of philosophical principles.

We have already remarked, that Sir Isaac Newton was led to the invention of the reflecting telescope from the difficulties which presented themselves in his endeavours to remove the defects of the refracting telescope. Many attempts were subsequently made by other philosophers with the same view; but the honour of complete success was reserved for Mr. John Dolland, who has immortalized his name by the invention of the achromatic telescope. Dolland was the son of a weaver in London, and in the early part of his life, worked at the loom; but his mind was given to the pursuit of the mathematics and natural philosophy, and all his leisure hours were devoted to study, or to the construction of sun-dials, and other instruments of science. By great industry, and by abridging the ordinary periods of repose, he acquired a considerable stock of general learning, became a practical optician, and commenced the business of manufacturing instruments: he introduced many improvements in their construction, and has, probably, brought the refracting telescope to the highest possible degree of perfection. His success in business was equal to his merits; his name was enrolled among those of the most distinguished philosophers, in several learned societies; he was appointed optician to the king, and was as highly regarded for his moral worth as he was admired and honoured for his genius and talents.

Sir William Herschell was by profession a musician, but being passionately fond of the sciences of optics and astronomy, in order more fully to pursue these subjects, he attentively studied the theory, and busied himself in the practice, of mechanics, particularly in the grinding and polishing of lenses and mirrors for telescopes, and other apparatus applicable to astronomical observations. Such was his industry, that with his own hands, he ground and polished more than four hundred speculæ, some of them of extraordinary size; and although in the nice operation of casting them of such dimensions as had not heretofore been attempted, he encountered numerous difficulties, and experienced many severe disappointments, he persevered with unabated zeal, and in the year 1781, by the aid of one of his own telescopes, discovered the planet which now generally bears his name. This event rewarded him for all his past labours, and stimulated him to fresh exertions. The attention of Europe was turned towards him; his sovereign allowed him an annuity; and in a few years after, he finished his telescope of forty feet in length, and nearly fifteen feet in circumference, with a mirror forty-nine inches in diameter, which, when cast, weighed 2118 lbs. This immense tube of sheet-iron, with its ponderous appurtenances, he suspended with great mechanical ingenuity, so that it can with facility be directed towards any part of the heavens.

He was enabled, by this instrument, which far surpassed all others in power, to enrich astronomy with numerous discoveries and observations; enlarging the boundaries of science, increasing his own fame, and augmenting the glory of his country.

One of the most striking examples of what may be accomplished by a powerful mind, unaided by the advantages of education, but dependant solely on the rescources of an extraordinary genius, in which intuition seems to have outstripped the march of science, is also exhibited in the life of James Brindley. His education had been neglected in consequence of the imprudence of his father, and he was compelled to perform that kind of labour which falls to the lot of the poorer class, until he was seventeen years of age. He then bound himself apprentice to a mill-wright, and at a very early period of his service, became the instructor of his master, and was preferred to him by his employers, when any thing was to be performed, which was new or difficult. Whatever he undertook, he accomplished; leaving on all his works the evidences of his superiority, in the improvements which he introduced. At the period when his skill, as a mechanic and engineer, had become extensively known, no canals of any great extent or importance, had been constructed in England. About the year 1758, the Duke of Bridgewater was desirous of extending one from the coal mines on his estates, to Manchester, about seven miles distant, and which, if accomplished, must be carried over rivers and deep vallies, and through subterraneous tunnels. Brindley surveyed the ground, and declared the work practicable; and although assailed by ridicule almost on every side, such was the duke's confidence in the talents of his adviser, that he determined upon its execution. When the canal had been completed as far as the river Irwell (which is navigable for large vessels), and Brindley proposed to cross it by an aqueduct, elevated thirty-nine feet above the surface of the water; an eminent engineer, who was consulted on the occasion, observed, that he had "heard of castles in the air, but had never before been shown where any of them were to be erected." In ten months after this, the aqueduct was completed, and the first boat passed through the air-built castle, whilst the vessels in the river pursued their ordinary course. The accomplishment of this undertaking established the credit of Brindley on an immoveable basis; the duke extended his canal to Liverpool, and the success of his efforts, caused many others to be immediately planned. In the execution of these, the services of Brindley were anxiously sought for, and always rendered with the same results, which had accompanied him in his former works. He died in his 56th year, leaving behind him a character for integrity, as spotless as his genius was great; having accomplished more during the comparatively short period which he devoted to internal improvements, than would have appeared possible, but for the testimony of his works.

(*To be continued.*)

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since October 28, 1829.

To Thomas John Fuller, of Commercial-road, Limehouse, in the county of Middlesex, Civil Engineer, for an improved mechanical power, applicable to machinery of different descriptions. Dated October 28, 1829.—To be specified in six months.

To George Daure, of Birmingham, in the county of Warwick, manufacturer; for a self-acting air or gas regulator, or stop-cock for governing the flow of air or gas, and which may also be applied to other purposes. Dated November 2, 1829.—In six months.

To John M'Curdy, of Great James-street, Bedford-row, in the county of Middlesex, gentleman; who, in consequence of a communication made to him by a certain foreigner residing abroad, is in possession of certain improvements in the method of constructing mills and mill-stones, for grinding. Dated November 2, 1829.—In two months.

To James Viney, of Piccadilly, colonel in the royal artillery; for certain improvements in steam boilers, and in carriages or apparatus connected therewith. Dated November 2, 1829.—In six months.

To James Soanes, Junior, of Wheeler-street, Spitalfields, in the county of Middlesex, soap maker; for a new preparation or manufacture, of a certain material, produced from a vegetable substance, and the application thereof to the purposes of affording light, and other uses. Dated November 2, 1829.—In two months.

To John Tucker, of Hammersmith, in the county of Middlesex, brewer; for an exploding shot, or projectile. Dated November 2, 1829.—In six months.

To James Stewart, of George-street, Euston-square, in the county of Middlesex, piano-forte maker; for certain improvements in piano-fortes. Dated November 2, 1829.—In two months.

To John Cowderoy, of Britannia-street, City-road, in the county of Middlesex, gentleman; for certain improvements in machinery for making bricks. Dated November 2, 1829.—In six months.

To Francis Naish, of Stoneason, near Wells, in the county of Somerset, gentleman; for certain improvements in the manufacture or application of silk, mixed or combined with other articles. Dated November 2, 1829.—In two months.

To William Gooch, of Mount-street, Berkeley-square, in the county of Middlesex; for certain improvements on baths of different descriptions, which improvements are also applicable to other purposes. Dated November 7, 1829.—In six months.

To Daniel Macdougal, of Edinburgh, Horticulturist; for certain improvements on or additions to syringes, applicable to garden and other purposes. Dated November 10, 1829.—In six months.

To Thomas Osler, of Birmingham, in the county of Warwick, chandelier furniture manufacturer; for certain new improvements in the construction of glass and metal chandeliers, and other articles for ornamental lighting. Dated November 10, 1829.—In six months.

To Joseph Gibbs, of Crayford Mill, in the county of Kent, timber merchant; for improvements in machinery for cutting marble, wood, and other substances. Dated November 12, 1829. In six months.

To John William Dodgson, of Lower Shadwell, in the county of Middlesex, pump and engine maker; for certain improvements in ship's scuppers, and which may also be applied to other purposes. Dated November 17, 1829 —In six months.

To Thomas Gethen, of Furnivals Inn, in the county of Middlesex, gentleman; for certain improvements in dressing woollen cloth. Dated November 21, 1829.—In six months.

To William Clutterbuck, of Oxlebrook, near Stroud, in the county of Gloucester; for certain improvements in the shears, used for cutting or cropping of woollen cloth, and other fabrics, requiring shearing Dated November 21, 1829.—In two months.

END OF THE FIFTH VOLUME.

PRINTED BY W. SPIERS, 399, OXFORD STREET.

INDEX TO THE FIFTH VOLUME.

Acetate of lime and copper, on, 228
Active molecules, Brown on, 337
Aikin, Dr., on the Bedford level, 213
Air in leaden conduit-pipes, Treadwell on removing, 198
Almond paste, 123
Amber, essence of, 148
American turning-lathe mandrel and chucks, Saxton's improved, 106
Antimony, diaphoretic, 53
Apparatus for producing instantaneous light, Jackson's, 21
Argenton, or German silver, on its preparation, 90
Arquebusade-water, 121
Arseniate of potash, 53
Art of the perfumer, on it, 112, 144
Atlas moth's feathers, T. Carpenter on them, 258
Bags, perfumed, 149
Bar-iron, Lagerhjelmn's experiments on, 298
Battea's odoriferous lamp, 125
Bedford level, Dr. Aikin on it, 213
Beef-suet, to prepare, for perfumes, 114
Beetle, water, T. Carpenter on a, 131
Bell's claims on steam navigation, 152
Bellows, portable, for miniature glass-blowing, Danger's, 24
Bergamotte pommade, 119
Birds, skins of, Waterton on preserving, 358
Bird's skill and science, 377
Black crayons, on making, 242
Blanc-manger, on preparing, 318
Bleaching, Smith on, 219
Blood, Editor on the globules in it, 336
Blue crayons, on making, 242, 243
Blue foil, on making, 210
Boat-fly, T. Carpenter on its darts, 195
Bones, D'Arcet on extracting gelatine from them, 169—Puymaurin on it, 313
Boot-maker's machine, Dowie and Black's, 74
Bottling sparkling liquors, on, 303
Bowles on French and Spanish nitre-works, 94—On Spanish iron, and Toledo sword-blades, 97, 101—On Spanish locusts, 107
Brazil-wood, Dingler on improving its red colour, 366
Bridgewater, Duke of, on his canals, 83
Brindley, James, on, 382
British iron trade, on its increase, 248
Brown coloured foil, on making, 212
Brown crayons, on making, 242
Brown on active molecules, 337
Bull on the draught in chimnies, 370
Burnet on the lapis ollaris or pot-stone, 276
Butcher's meat, D'Arcet on extracting gelatine from the bones in it, 169
Buttercup and poppy, Whitlaw on their ill effects, 56

INDEX.

Cable-chain, accident to one, 272
Calico-printing by fusible metal plates, 310
Calico dyeing and print works, Lettice on Scotch ones, 347
Canals, on the Duke of Bridgewater's, 83
Canals, navigable, on inventions connected therewith, 188
Cape wines, Sinclair on improving, 166
Cape of Good Hope and the Mauritius, Sinclair on improving the settlements at, 169
Capsus spissicornis, T. Carpenter on its antennæ, 197
Carbonate-sub, of potash, 52
Carnations, powder of, 149
Carpenter, T. on the ephemeron, 6—On P. Carpenter's solar microscope, 6, 65—On the larva of the musca chameleon, 11—On the musca pendula, 13—On the scales of the guard-fish, 19—On a gnat's wing, 20—On the microscope, 65—On the teeth of the tad-pole, 68—On the larva of a dyticus, 69—On the pselaphus, 69—On a sand-wasp, 70—On the wing-cases of a cicada, 71—On the feathery hairs on the fins of lobsters, 72—On humming bird's feathers, 72—On the scales upon the skin of a Chinese flying-fish, 72—On fungi in wheat, 129—On a cimex, 131—On a water-beetle, 131—On the tussock moth, 194 On the darts of a boat-fly, 195—On the eyes of the hydrometra stagnorum, 195—On the antennæ of the capsus spissicornis, 197—On the darts of a gnat, 328—On crystallizations in the poison of wasps, 330
Carpenter, Philip, on his solar microscope, 6, 65
Carron iron-works, Lettice on them, 351
Cashmeer shawl goat, naturalized by C. T. Tower, 87
Cassia pommade, 115—Oil of, 116—Spirit of, 118
Cast-iron, Treadwell on using and improving, 222
Castellani on colouring gold works yellow, 206
Cattle, diseased, and bad meat, Whitlaw on, 291
Cedrat pommade, 119
Chain-cable, accident to one, 272
Chara translucens, on the circulation of the sap in it, 262
Chimnies, Bull on the draught in 370
Chinese flying-fish, T. Carpenter on the scales upon its skin, 72
Chinese white copper or packfond, 94
Chromates of iron and potash, 54
Chronometers, Parkinson and Frodsam's, 378
Chucks and mandrels for lathes, Saxton's improved American ones, 106
Cicada, T. Carpenter on the wing-cases of one, 71
Cimex lectularius, T. Carpenter on its eggs, 72
Cimex, T. Carpenter on one, 131
Cinnamon pommade, 119
Citron pommade, 119
Coloured foils, manufacture of, 208
Colouring steel, Nobili on, 203
Colouring gold works yellow, Castellani on, 206
Combs of tortoise-shell and horn, Editor on, 317
Conduit-pipes, leaden, Treadwell on freeing, from air, 198
Cooper's matches, tipped with sulphur and phosphorus, 266
Copper, white, Chinese, 94
Coralline, microscopic view of, 143
Cotton mills, Lettice on those at Rothesay, 344
Crane-ladder, Hilton's, 25
Crayons, on preparing, 235
Crystallizations in the poison of wasps, T. Carpenter on, 330
Cytherea, spirit of, 119

Darts of a gnat, T. Carpenter on them, 328
Darts of garden snails, T. Carpenter on them, 261
D'Arcet on extracting gelatine from bones, 169
D'Arcet on refining gold and silver at Paris, 277, 356
Danger's portable bellows for miniature glass-blowing, 24
Dayes on the use of drawing, 29
Deaf persons, Pointer's instrument for, 106
De Claubry on using fusible metal roundels in steam-boilers, 353
Dentrifice waters, 122
Detonating caps, 124
Diaphoretic antimony, 53
Dingler, Dr., on improving the red colour of Brazil-wood, 366
Dolland, John, on, 380
Dowie and Black's boot and shoe maker's machine, 74
Duke of Bridgewater's canals, 83
Draught in chimnies, Bull on it, 370
Drawing, Dayes on the use of, 29
Dyeing human hair, Gendrin on, 202
Dyticus, T. Carpenter on the larva of one, 69, 260
Eau de Cologne, 120
Eau de mille fleurs, 121
Eau balsamique ethérée, 122
Eau de Mousseline, 122
Editor on the microscope, 1, 129, 193, 257, 327
Editor on the exuviæ of the larvæ of the ephemeron, 2
Editor on mounting transparent objects for the microscope, 4
Editor on a beautiful larva, 143
Editor's improved match cord, 272
Editor on the silex in straw, 309
Editor on tortoise-shell and horn combs, 317
Editor on Wollaston's microscopic doublet, 326
Editor on the globules in the blood, 336
Editor on a renovator for razor-strops, 368
Eels in paste, W. Tulley's microscopic view of, 142
Effacing in lithography, on, 61
Eggs of the cimex lectularius, T. Carpenter on them, 75
Electrum, or German silver, on its preparation, 90
Ely fens, Dr. Aikin on them, 213
English vermillion, on, 228
Ephemeron, Reaumur on it, 8
Ephemeron, Editor on the exuviæ of its larva, 2
Esprit d'ambrette, 148
Essential oils, 117
Essences, French, 147
Essence of musk, 147—Amber, 148—Rhodes, 148—Vanilli, 148
Evaporating syrups, apparatus for, 251
Exuviæ of the larva of the ephemeron, 2
Exuvia of the pupa of the ephemeron, 2
Extrait de bouquet, 120
Eye of the haddock, Dr. Letsom's preparation of, for the microscope, 329
Eyes of a water-beetle, T. Carpenter on their singular position, 131
Eyes of the hydrometra stagnorum, T. Carpenter on them, 195
Fard, white, 146
Fat, to prepare, for perfumers, 113
Fat from bones, D'Arcet on extracting, 181—Puymaurin on it, 313
Feathers of the humming-bird, T. Carpenter on them, 72
Feathery hairs on the fins of a lobster, T. Carpenter on them, 72
Feathers of a gnat's wing, T. Carpenter on, 259

INDEX.

Ferguson, James, on, 379
Fire-bottles, phosphoric, to prepare, 264, 266
Flowers, Italian spirit of, 118
Flying-fish, Chinese, T. Carpenter on the scales upon its skin, 72
Foils, coloured, on manufacturing, 208
French and Spanish nitre works, Bowles on, 94
French perfumery articles, on making, 112
Fungi in wheat, T. Carpenter on, 129
Fusible metal plates for calico-printing, 310
Fusible metal roundels, De Claubry on using, in steam-boilers, 353
Garden snails, T. Carpenter on their darts, 261
Gelatine from bones, D'Arcet on extracting, 169—Puymaurin on it, 313
Gendrin on dyeing human hair, 202
German silver, or electrum, on preparing, 90
German polish for wood, Hawkins on it, 103
Glass-works at Dumbarton, Lettice on, 350
Gloves, pommade, 149
Glow-worm, T. Carpenter on it, 332
Goat, shawl, of Cashmere, naturalized by C. T. Tower, 87
Gold, crystallized, 143
Gold and silver refining at Paris, D'Arcet on, 277, 356
Gold-works, Castellani on colouring them yellow, 206
Gnat, change of a nais into one, 2
Gnat's wing, T. Carpenter on it, 20
Gnat, T. Carpenter on the darts of one, 328
Graham's skill and science, 377
Grain of sand, microscopic view of a, 143
Grasse, on the perfumes from thence, 113
Great water-beetle, on its larva, 3
Great works of the Bedford Level, Dr. Aikin on them, 213
Green crayons, on making, 242
Green foil, on making, 210
Guard-fish, T. Carpenter on its scales, 19
Haddock's eye, Dr. Letsom's microscopic preparation of it, 329
Hartshorn Jelly, on preparing, 318
Hawkins on the German polish for wood, 103
Herschell, Sir William, on, 381
Hilton's ladder-crane, 25
Honey water, 121
Honey almond paste, 144
Horn and tortoise-shell combs, Editor on, 317
Houlton on the stachis palustris, 27
Human hair, Gendrin on dyeing it, 202
Humming-bird's feathers, T. Carpenter on them, 72
Hydrophilus, larva of it, 3
Hydrometra stagnorum, T. Carpenter on its eyes, 195
Instantaneous light, Jackson's, 21
Instantaneous lights, on preparing and using, 264
Iodine used in dyeing, &c. 228
Iron, chromate of, 54
Iron, Spanish and Toledo sword-blades, Bowles on, 97, 101
Iron, bar, Lagerjhelmn's experiments on, 289
Iron trade, on the British, 248
Italian spirit of flowers, 118
Jackson's instantaneous light apparatus 21
Jasmine pommade, 116—Spirit of 118
Jelly, hartshorn, on preparing, 318
Jones on the union of mechanical skill with science, 374

Jonquille pommade, 116
Jonquille coloured foil, on making, 212
Ladder-crane, Hilton's, 25
Lagerhjelmn's experiments on bar iron, 289
Lamp, Battea's odoriferous one, 125
Lampyrus noctiluca, T. Carpenter on it, 332
Lapis ollaris, or pot-stone, Burnet on, 276
Lard, to prepare, for perfumers, 114
Larva of the musca chameleon, Linnæus on it, 13—Of the hydrophilus, 3—Editor on a beautiful one, 143
Lathe mandrel and chucks, Saxton's improved American ones, 106
La Torre's spherules for microscopes, 337
La Torre on the globules in blood, 337
Lavender, essence of, 117—Pommade, 119—Water, 121
Leaden conduit-pipes, Treadwell on freeing them from air, 198
Letsom's preparation of the eye of a haddock, 329
Lettice on the Rothesay Cotton-mills, 344—On calico dyeing and printing works, 347—On the Carron iron works, 351
Light, instantaneous, Jackson's, 21
Lights, instantaneous, on preparing and using, 264
Lilac coloured foil, on making, 211
Limette pommade, 119
Linnæus on the larva of the musca chameleon, 13
Liquid almond pastes, 144
Lists of patents, monthly, 63, 127, 190, 255, 320, 383
Lithography, on effacing in, 61
Lobster, T. Carpenter on the feathery hairs of its fins, 72
Locusts, Bowles on Spanish ones, 107
Lycæna Adonis butterfly, T. Carpenter on its scales or feathers, 258
Machine for boot and shoe makers, Dowie and Black's, 74
Match-cord, Editor's improved, 272
Matches tipped with sulphur and phosphorus, 266
Marine polype, 143
Mauritius, Sinclair on improving the settlement there, 168
Meat, bad, from diseased cattle, Whitlaw on, 291
Mechanical discoveries, Nicholson on the progress of, 184
Mechanical skill, Jones on its union with science, 374
Merimée on improving razor-strops, 367
Métallo-chromie, Nobili's, 203
Microscopic tubes from the larva of a gnat, 1
Microscope, Editor on it, 1, 129, 193, 257, 327
Microscope, T. Carpenter on it, 65, 129, 193, 257, 327
Microscope, solar, on P. Carpenter's, 6, 65
Microscopic objects, Editor on mounting transparent ones, 4
Microscopic doublet, Wollaston's, 321
Midge-fly, T. Carpenter on its wings, 328
Miniature glass-blowing, Danger's portable bellows for, 24
Mite, Editor, on a pectinated one, 264
Molecules, Brown on active ones, 337
Monoculi, T. Carpenter on their shells, 335
Monthly list of patents, 63, 127, 190, 255, 320, 383
Musca pendula, T. Carpenter on it, 13
Musca chameleon, T. Carpenter on its larva, 11—Linneus on it, 13
Musk, essence of, 147
Musk-roses, powder of, 149
Mutton-suet, to prepare for perfumes, 114
Nais changed into a gnat, 2
Narcissus pommade, 116

Navigation, steam, Bell's claims on, 152
Navigable canals, on inventions connected with them, 188
Neroli, essence of, 117
Newton, Sir Isaac, on, 378
Nicholson on the progress of mechanical discoveries, 184
Nitrates, on, 41
Nitrate of potash, on, 41—Of strontian, 55
Nitre, on, 41
Nitre-works, Bowles on the French and Spanish, 94
Nobili on ornamenting steel, 203
Odoriferous lamp, Battea's, 125
Odorous extracts, 120
Oils, perfumed, 116
Orange-flower pommade, 115—Oil of, 116—Spirit of, 118
Orange flower pastils, 146,
Ovalites in Paris sand, T. Carpenter on them, 139
Oxygenated matches, on, 267
Packfond, or Chinese white copper, 94
Parfum des rois, 146
Paris perfumery articles, 11
Paris sand, T. Carpenter on ovalites in it, 139
Parkinson and Frodsam's chronometers, 378
Pastils, on preparing, 235—French, 146
Patents, monthly list of, 63, 127, 190, 255, 320, 383
Peach-blossoms, extract of, 120
Pectinated mite, Editor on one, 264
Perfumery, French, on making, 112, 144
Perfumes from Grasse, on them, 113
Perfumed bags, 149—Oils, 116
Petit grain, essence of, 117
Phillips, W., on the Paris sand, 140
Phosphorus, fire-bottles to prepare, 264, 266
Platina boilers for refining gold and silver, 286, 356
Playfair on Rupp's great timber-slide, 229
Pointer's instrument for deaf persons, 106
Poison of wasps, T. Carpenter on crystallizations formed therein, 330
Polish or varnish for wood, Hawkins on the German, 103
Polypes, T. Carpenter on them, 132
Pommade gloves, 149
Poppy and butter-cup, Whitlaw on the ill effects of them, 56
Poppy coloured foil, on making, 24
Porcupine's quill, microscopic views of it, 143
Pork-fat, to prepare, for perfumes, 114
Portable bellows for miniature glass-blowing, 24
Portugal pommade, 119
Potash, sub-carbonate of, 52—Arseniate of, 53—Chromate of, 54
Prints on transferring to wood, and varnishing, 244
Pritchard on the exuvia of the larva of the ephemeron, 2
Promothean instantaneous lights, 271
Pselaphus, T. Carpenter on it, 69
Pupa of a gnat, a nais changed into one, 2
Puss moth's feathers, T. Carpenter on them, 258
Puymaurin on extracting gelatine from bones, 313
Razor-strops, Merimée on improving, 367—Editor on a renovator for, 368
Reaumur on the ephemeron, 8—On the muscula pendula, 15
Red foil, on making, 210
Red crayons, on making, 242, 243
Refining gold and silver at Paris, D'Arcet on, 277, 356

Rennie on cast-iron, &c. 227
Renovator for razor-strops, Editor on one, 368
Rhodes, essence of, 148
Roman pommade, 119
Roots of the stachis palustris, Houlton on them, 27
Rose coloured foil, on making, 211
Rosemary, essence of, 117—Pommade, 119
Rose pastils, 146—Pommade, 114
Roses, oil of, 116—Essence of, 117—Spirit of, 118
Roses, musk, powder of, 149
Rose vinegar, 150
Roth's vacuum-pan for evaporating syrups, 252
Rouge, to prepare, 145
Ruby coloured foil, on making, 211
Rupp's great Timber slide, Playfair on, 229
Sand from Paris, T. Carpenter on the ovalites in it, 139
Sand-wasp, T. Carpenter on one, 69
Sap, on its circulation in the chara translucens, 262
Saxton's improved American turning lathe mandrel and chuck, 106
Scales of the guard fish, T. Carpenter on them, 19
Scarlet foil, on making, 211
Scented powders, 149
Scorzonera, Turck on feeding silk-worms on it, 212
Scotch calico-dyeing and printing-works, Lettice on, 347
Shoe-maker's machine, Dowie and Black's, 74
Silex, form of, in straw, Editor on, 337
Silk-worms, Turck on feeding with the scorzonera, 212
Silex, Editor on its form in straw, 309
Silver, German, or Electrum, on preparing, 90
Silver and Gold, D'Arcet on refining, at Paris, 277, 356
Sinclair on improving our settlements at the Cape of Good Hope and Mauritius, 161—On improving Cape wines, 166
Skins of birds, Waterton on preserving them, 358
Smith, on bleaching, 219
Snails, garden, T. Carpenter on their darts, 261
Solar microscope, on P. Carpenter's, 6, 65
Sommorostro, Bowles on the Spanish iron mine and forges there, 101
Spanish and French nitre-works, 94—Spanish iron mine and forges, 101
Spanish iron and Toledo sword-blades, 97, 101—Spanish locusts, 107
Sparkling liquors, on bottling, 303
Specular iron ore, artificial, Merimée on using for razor-strops, 367
Sphagnum acutifolium, T. Carpenter on it, 334
Spherules for microscopes, La Torre's, 337
Spirit of sweets, 118
Spirit varnish, white, to make, 246
Stachys palustris, Houlton on it, 27
Steam-boilers, De Claubry on using roundels of fusible metal in, 353
Steam-navigation, Bell's claims on, 152
Steatite used to lubricate machinery, 273
Steel, Nobili on ornamenting it, 203
Straw, Editor on the silex in it, 309
Strontian, nitrate of, 55
Srops for razors, Merimée on improving, 367
Sub-carbonate of potash, 52
Suet, to prepare, for perfumes, 114
Sword-blades, Toledo, Bowles on, 97
Syrups, apparatus for evaporating 251

Tadpole, T. Carpenter on its teeth, 68
Teeth of the tad-pole, T. Carpenter on them, 68
Tenthredo, or saw-fly, T. Carpenter on it, 260
Thrips, elytra and wing of, T. Carpenter on them, 259
Thyme, essence of, 117—Pommade, 119—Vinegar, 150
Timber slide at Alpnach, Rupp's, 229
Toledo sword-blades, Bowles on, 97
Tortoise-shell and horn combs, Editor on, 317
Tower, C. T. on naturalizing the cashmeer shawl-goat, 87
Transferring prints to wood, and varnishing them, 244
Transparent microscopic objects, Editor on mounting, 4
Treadwell on freeing leaden conduit-pipes from air, 198—On using and improving cast-iron, 222
Tube-rose pommade, 116—Spirit of, 118
Tubes, microscopic, from the larva of a gnat, 1
Tulley's, W. microscopic view of the eels in paste, 142
Turck on feeding silk-worms with the scorsonera, 212
Turning-lathe mandrel and chucks, Saxton's improved American, 106
Tussock moth, T. Carpenter on it, 194
Vacuum-pan, Roth's, for evaporating syrups, 253
Vanille pastils, 147—Essence of, 148
Varnish, or polish for wood, Hawkins on the German, 103
Varnish, white spirit, to make, 246
Varnishing horn combs, Editor on, 318
Vermillion, English, on, 228
Vinegars for the toilette, 150
Vinegar of four thieves, 150—De rouge, 151
Violet pommade, 116
Violets, spirit of, 118
Violet coloured foil, on making, 211
Wasp-sand, T. Carpenter on one, 69
Wasps, T. Carpenter on crystallizations formed in their poison, 330
Water-beetle, on its larva, 3—T. Carpenter on one, 131
Waterton on preserving the skins of birds, 358
Wheat, T. Carpenter on fungi in, 129
White copper, or Chinese packfond, 94
White crayons, on preparing, 240
White spirit varnish, to make, 246
Whitlaw on the ill effects of the poppy and the butter-cup, 56—On diseased cattle, and bad meat, 291
Wild thyme, essence of, 117
Wines, Cape, Sinclair on improving, 166
Wing-cases of a boat-fly, 195—Of a cicada, T. Carpenter on them, 71
Wollaston's microscopic doublet, 321
Wood, German polish for, Hawkins on it, 103
Wood, on transferring prints to, and varnishing them, 244
Yellow crayons, on making, 241.

Fig. 6.

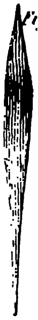


Fig. 5.

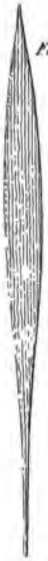


Fig. 3.

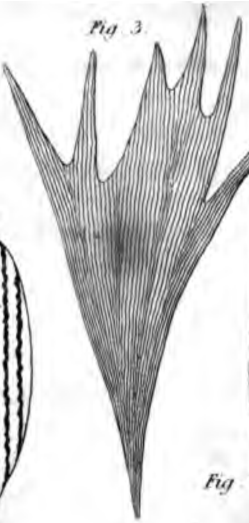


Fig. 2.

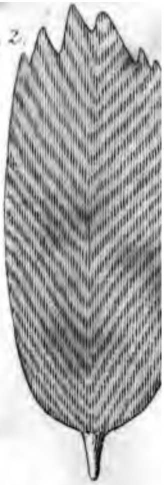


Fig. 1.

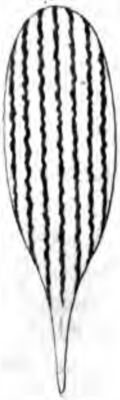


Fig. 4.

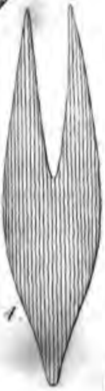


Fig. 7.

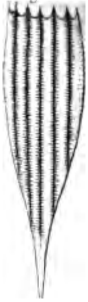


Fig. 9.

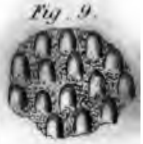


Fig. 12.

Fig. 10.

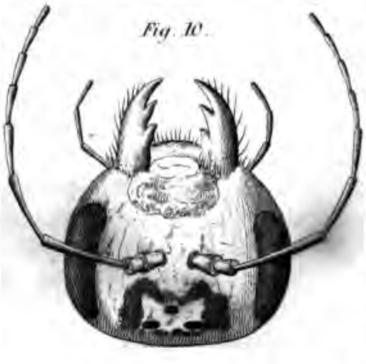


Fig. 16.

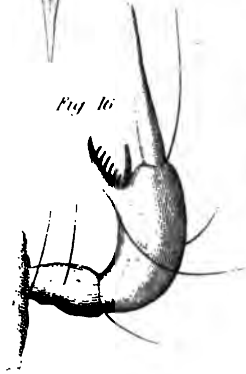


Fig. 8.

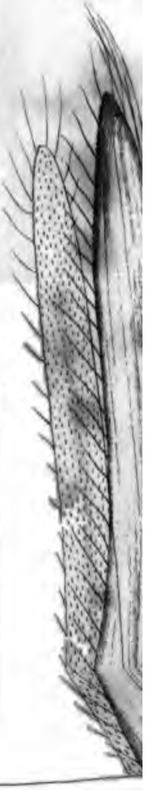


Fig. 15.

Fig. 11.

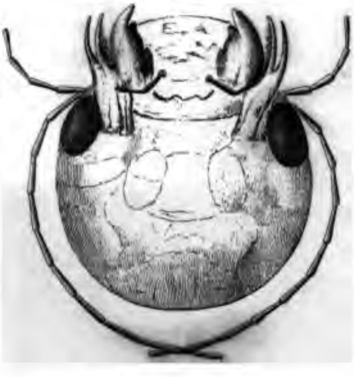
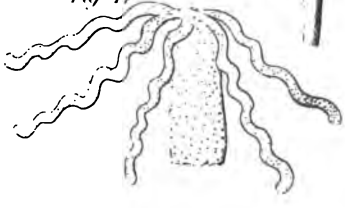


Fig. 13.

Fig. 14.



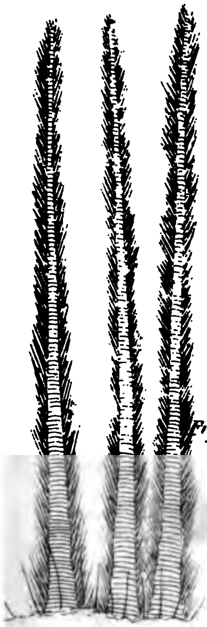


Fig.

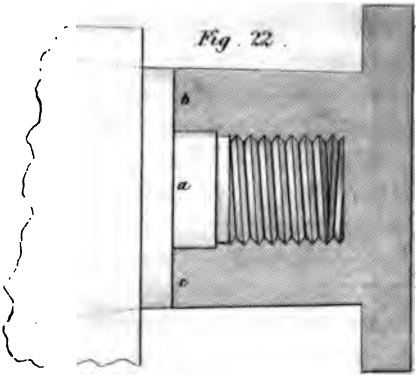


Fig. 22.

Fig. 11.

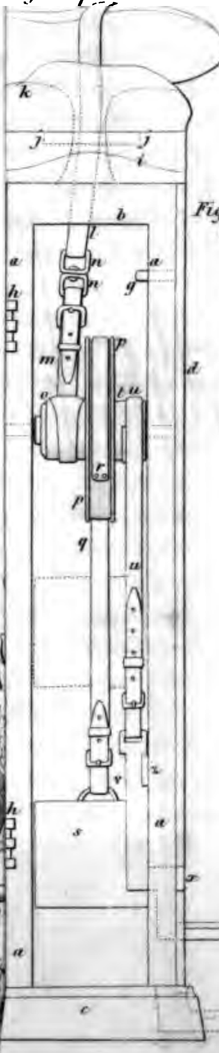


Fig. 12.

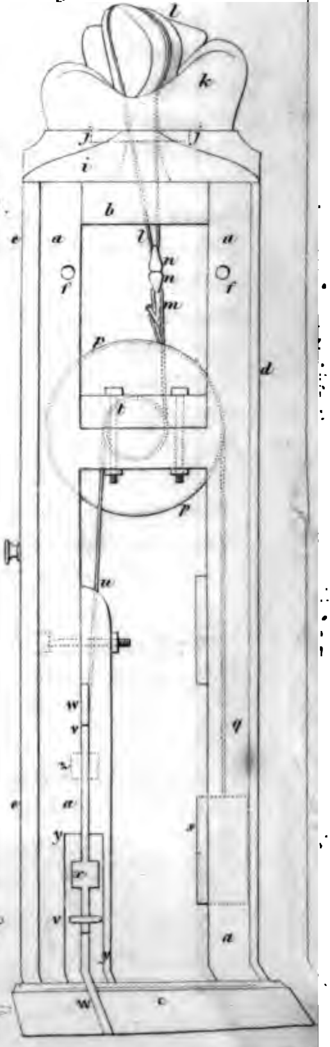


Fig. 13.

Fig. 10.

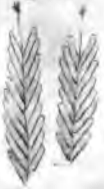
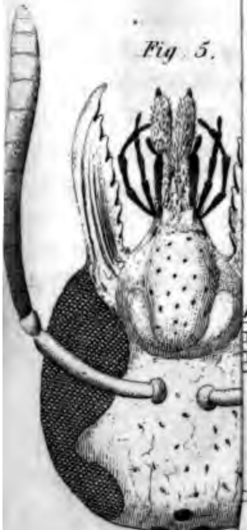


Fig. 5.



E. Tur

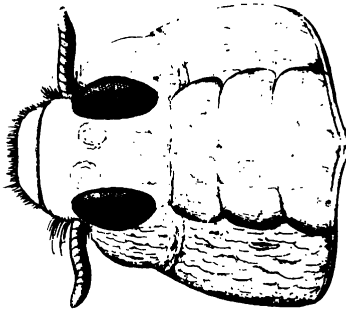


Fig. 2.

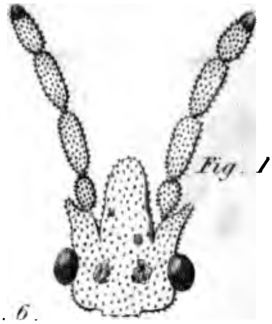


Fig. 1.

Fig. 6.

Fig. 3.

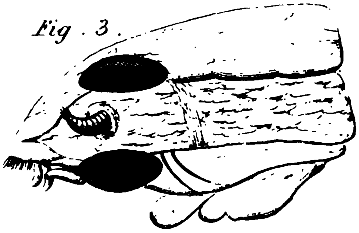


Fig. 5.

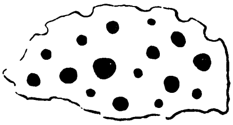


Fig. 7.

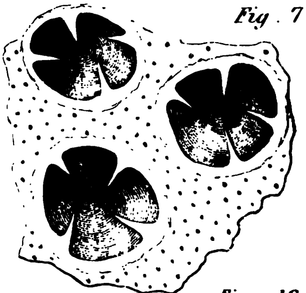


Fig. 4.

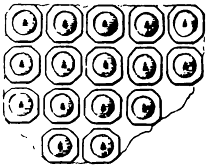


Fig. 9.

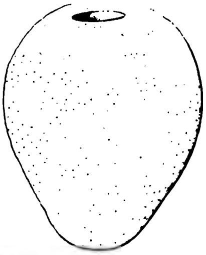


Fig. 8.

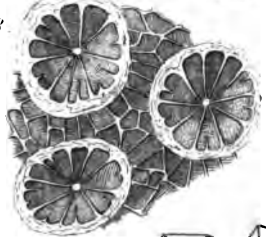


Fig. 10.

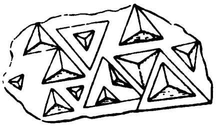


Fig. 16.

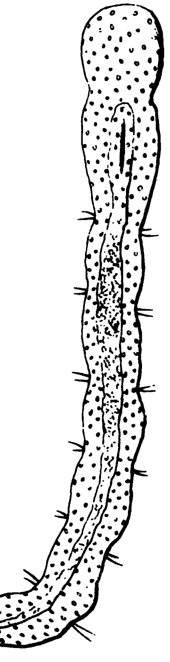


Fig. 13.

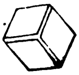


Fig. 11.

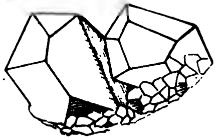


Fig. 12.

Fig. 14.

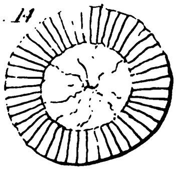


Fig. 15.